NASA

# Aeronautical Engineering
## A Continuing Bibliography with Indexes

NASA SP-7037(107)
March 1979



National Aeronautics and Space Administration

Aeronautical Engineering
A Continuing Bibliography with Indexes

Pages 51–109

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Accession numbers cited in this Supplement fall within the following ranges.

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| STAR (N-10000 Series) | N79-11995 - N79-13996 |
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NASA SP-7037 (107)

# AERONAUTICAL ENGINEERING

## A Continuing Bibliography

## Supplement 107

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in February 1979 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA)*

NASA Scientific and Technical Information Branch 1979
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# INTRODUCTION

Under the terms of an interagency agreement with the Federal Aviation Administration this publication has been prepared by the National Aeronautics and Space Administration for the joint use of both agencies and the scientific and technical community concerned with the field of aeronautical engineering The first issue of this bibliography was published in September 1970 and the first supplement in January 1971 Since that time, monthly supplements have been issued

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 439 reports, journal articles, and other documents originally announced in February 1979 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries*, in that order The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* and *STAR*, including the original accession numbers from the respective announcement journals This procedure, which saves time and money, accounts for the slight variation in citation appearances

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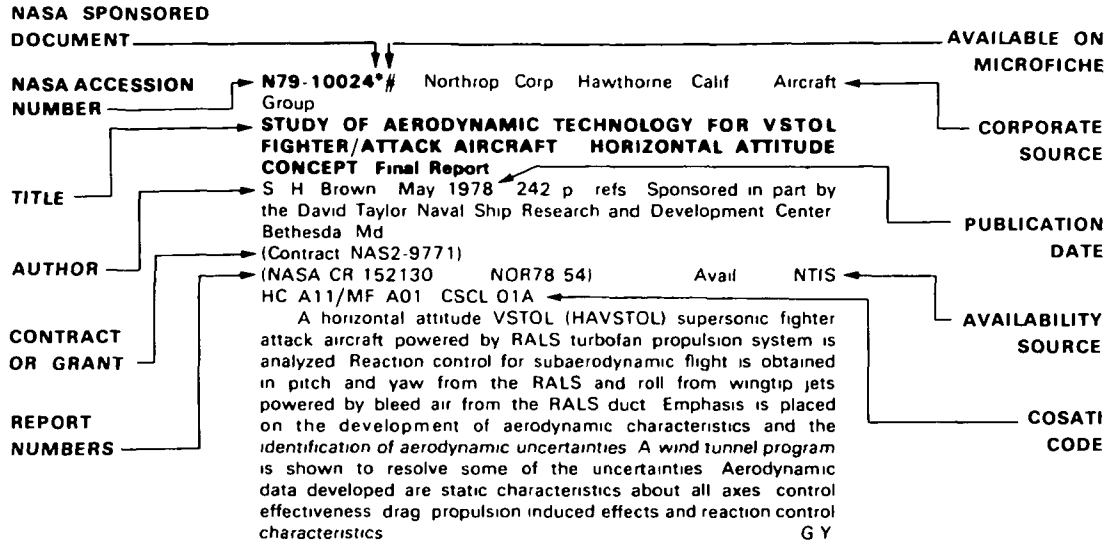


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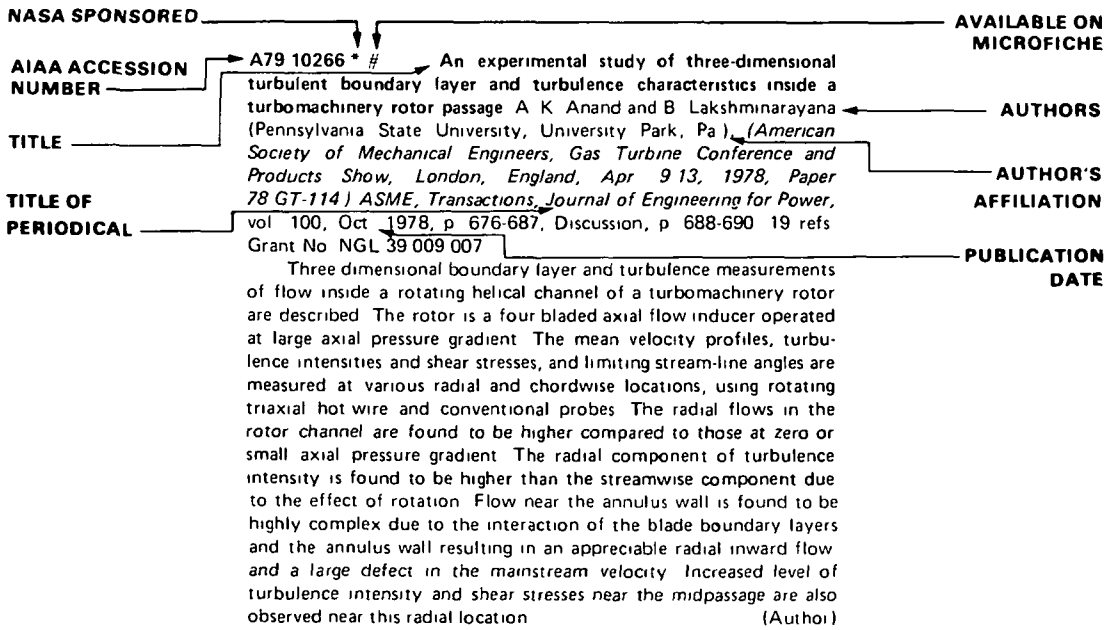

# AERONAUTICAL ENGINEERING

*A Continuing Bibliography (Suppl. 107)*

MARCH 1979

## IAA ENTRIES

**A79-12977** **Alternative hydrocarbon fuels Combustion and chemical kinetics, SQUID Workshop, Loyola College, Columbia, Md , September 7-9, 1977, Technical Papers** Workshop sponsored by the U S Navy, U S Air Force, and U S Department of Energy, Project SQUID Edited by C T Bowman (Stanford University, Stanford, Calif ) and J Birkeland (U S Department of Energy, Washington, D C ) New York, American Institute of Aeronautics and Astronautics, Inc (Progress in Astronautics and Aeronautics Volume 62), 1978 476 p Members, $20 , nonmembers, $35

The considered topics are related to alternative fuel availability and anticipated combustion problems, critical processes in the combustion of alternative fuels, pyrolysis and oxidation kinetics of alternative fuels, pollutant emissions considerations for alternative fuel combustion, and questions of alternative fuels policy and technology Attention is given to alternative fuels and combustion problems, future fuels in gas turbine engines, alternative fuels for reciprocating internal combustion engines, the use of alternative fuels in stationary combustors, alternative fuels in gas turbine combustors, combustion and chemical kinetics problems in internal combustion engines, the combustion of droplets and sprays of some alternative fuels, flame emissivities in the case of a use of alternative fuels, the pyrolysis and oxidation of aromatic compounds, the combustion chemistry of chain hydrocarbons, liquid phase reactions of vaporizing hydrocarbon fuels, the role of aromatics in soot formation, the kinetics of nitric oxide formation in combustion, and emission control techniques for alternative fuel combustion G R

**A79-12979** # **Future fuels in gas turbine engines** W S Blazowski (Exxon Research and Engineering Co , Linden, N J ) and L Maggitti (U S Naval Air Propulsion Test Center, Trenton, N J ) In Alternative hydrocarbon fuels Combustion and chemical kinetics, SQUID Workshop, Columbia, Md , September 7 9, 1977, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 21-72, Discussion p 72, 73 92 refs

A review is conducted of potential combustion problems associated with the utilization of future fuels in gas turbine engines, and prospects for coping with these difficulties are considered Increased cost and reduced availability of jet fuels, along with the potential future depletion of world-wide petroleum resources, has created an interest in the feasibility of obtaining jet fuel from nonpetroleum resources Crude oils from coal, oil shale, and tar sands, alone or in mixtures with petroleum crudes, are likely possibilities Because of basic chemical differences in these crudes, and processing economics, future fuels may have properties that are different from those of current fuels Programs are necessary to provide the information base for future specifications The end objective is to optimize the factors of availability, cost, aircraft performance, and safety G R

**A79 12982** # **Ignition/stabilization/atomization - Alternative fuels in gas turbine combustors** A H Lefebvre, A M Mellor, and J E Peters (Purdue University, West Lafayette, Ind ) In Alternative hydrocarbon fuels Combustion and chemical kinetics, SQUID Workshop, Columbia, Md , September 7 9, 1977, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 137 158, Discussion, p 158, 159 25 refs Research supported by the Ford Motor Co , Grant No DAAE07 76 C-0063

It is pointed out that fuel preparation, ignition flame spreading, and flame stabilization are important considerations in the design of gas turbine engines It is discussed how changes in the major properties of alternative fuels will affect atomization, ignition, flame spread, and lean blowoff in gas turbine burners It is found that it is primarily the physical properties of the fuel which influence the performance parameters Studies have shown that ignition is strongly dependent on fuel volatility and viscosity A graph showing the influence of atomization quality on ignition limits is presented For all fuels considered the atomization quality is found to be markedly inferior to that of normal kerosine, indicating that problems of ignition and lean blowoff will be more severe The correlations predict that jet fuels derived from shale oils, tar sands, and coal syncrudes will pose more serious problems of atomization than similar petroleum based fuels G R

**A79 12984** # **Flame emissivities Alternative fuels** A F Sarofim (MIT, Cambridge, Mass ) In Alternative hydrocarbon fuels Combustion and chemical kinetics, SQUID Workshop, Columbia, Md , September 7 9, 1977, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 199 227, Discussion, p 227 229 72 refs

An understanding of radiative heat transfer from combustion products is needed for the prediction of thermal efficiency and heat flux distribution in furnaces and for the estimation of the thermal punishment of the confining walls in internal combustion engines and gas turbines The emissivities of combustion products are considered, taking into account carbon dioxide, water vapor, the overlap correction factor, soot, carbonaceous particles, the emissivities of mixtures of solids and gases, furnaces fired with low or intermediate Btu gas, the effect of H/C ratio on the nonluminous contribution to emissivity, the emissivity of coal combustion products, Diesel engines and gas turbines It is found that the expected shift from petroleum-derived oils to coal-derived liquids would have only a modest effect on the nonluminous contribution to radiation in a large-scale combustor The greatest potential impact of increases in radiation anticipated with increases in the C/H ratio of fuels is in the design of gas turbine combustors G R

**A79-13077** # **Impact of fuel availability and other cost trends on air carrier operations** J D Smith (United Air Lines, Inc , Chicago, Ill ) In Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D C , November 17 19, 1977, Proceedings Washington, D C , Radio Technical Commission for Aeronautics, 1977, p 17 36

The paper reviews fuel-cost trends with reference to the airline and industry point of view Consideration is given to questions of fuel supply, conservation, future fuel requirements, productivity, and equipment procurement It is noted that the use of new technology and alternative fuels may be able to hold fuel-cost and other inflation factors to levels that will not price air travel out of the transportation market B J

**A79-13078** # **Impact of fuel availability and other cost trends on general aviation** J H Winant (National Business Aircraft Association, Inc , Washington, D C ) In Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D C , November 17-19, 1977, Proceedings Washington, D C , Radio Technical Commission for Aeronautics, 1977, p 37-41

The response of general aviation to the 'energy crisis' and to the need for the creation of a national energy policy is considered It is emphasized that a national energy policy should stress the development of new energy sources as well as conservation A bright future is forecast for general aviation, given a national policy which will aim for the elimination of government regulation, for intensified conservation, for the development of new petroleum sources, and for alternative fuel sources B J

**A79-13079** * # **Resource conservation through airborne electronics** L W Taylor, Jr (NASA, Electronics Div , Washington, D C ) In Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D C , November 17-19, 1977, Proceedings Washington, D C , Radio Technical Commission for Aeronautics, 1977, p 43 50 9 refs

Avionics can play a significant role in making aircraft more fuel-efficient through active controls and the accompanying structural and aerodynamic configuration changes In addition, avionics can make aircraft operations more efficient through advanced guidance systems This paper discusses some of these techniques, reviews their potential benefits, and examines certain related NASA programs B J

**A79-13080** # **Resource conservation through air traffic control** F L Cunningham (FAA, Air Traffic Service, Atlantic City, N J ) In Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D C , November 17 19, 1977, Proceedings Washington, D C , Radio Technical Commission for Aeronautics, 1977, p 51-57

Ongoing FAA programs concerned with fuel conservation through the modification of ATC operations are briefly reviewed Consideration is given to programs designed to combat excessive or unnecessary fuel burn These programs are directed primarily toward (1) more efficient airspace utilization, (2) reduction of engine run time, (3) procedural modification to accommodate more efficient flight paths and profiles, and (4) relocation of unavoidable airborne delays to higher, more economical altitudes B J

**A79-13082** # **ARINC Communications Addressing and Reporting System /ACARS/ - The data link that got implemented and why** N D Steele, Jr (Aeronautical Radio, Inc , Annapolis, Md ) In Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D C , November 17 19, 1977, Proceedings Washington, D C , Radio Technical Commission for Aeronautics, 1977, p 79 84

The development program of the ACARS data link is reviewed ACARS is characterized more as an augmentation of ARINC's and airlines' communications and information processing capabilities than as a distinct new system The immediate impact of ACARS on ARINC's domestic air/ground/air communications service is to reduce the requirement for voice communications and the personnel resources involved in handling voice transactions Economic factors associated with ACARS are discussed B J

**A79-13083** # **Technological advancements in general aviation avionics** C B Husick (Narco Scientific Industries, Narco Avionics, Fort Washington, Pa ) In Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D C , November 17 19, 1977, Proceedings Washington, D C , Radio Technical Commission for Aeronautics, 1977, p 93-103

Some areas for improvement in conventional applications of general aviation avionics are discussed, including (1) reduction in avionic systems weight and size, (2) reduction in systems cost, (3) improvement in system performance and reliability, and (4) improvement in navigational techniques Future prospects in the field are also discussed, including (1) computer aided flight planning, (2) propulsion system management and control, (3) system diagnosis interconnect for maintenance, and (4) a new approach to future system design B J

**A79-13084** # **The evolving air transport avionics** B C Hainline (Boeing Commercial Airplane Co , Renton, Wash ) In Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D C , November 17-19, 1977, Proceedings Washington, D C , Radio Technical Commission for Aeronautics, 1977, p 115-138

Avionics system design and evolution are discussed in the framework of the total air transportation system Operational environment considerations are examined with reference to ATC systems, navigation aids, and energy conservation In a review of current systems configurations, attention is given to Cat III Autoland capabilities, inertial reference systems, primary thrust control, functional modularity, the digital technology baseline, and functional partitioning Diagrams illustrating the basic configurations are presented B J

**A79 13085** # **Pilot's view of the evolving air transport** H R Lahr (United Airlines, Inc , Chicago, Ill , Air Line Pilots Association, Washington, D C ) In Radio Technical Commission for Aeronautics, Annual Assembly, Washington, D C , November 17 19, 1977, Proceedings Washington, D C , Radio Technical Commission for Aeronautics, 1977, p 139-145

The pilot's role in conserving energy is described and attention is given to the impact of energy conservation efforts on evolving air transport Some proposals for conserving fuel during various phases of the flight operation are discussed B J

**A79-13150** **Measurements in three-dimensional turbulent boundary layer on a yawed flat plate induced by leading edge vortex** N V C Swamy, B H L Gowda, and V R Lakshminath (Indian Institute of Technology, Madras, India) In Structure and mechanisms of turbulence I, Proceedings of the Symposium on Turbulence, Berlin, West Germany, August 1-5, 1977 Berlin, Springer-Verlag, 1978, p 217-221

Results of the mean velocity and turbulence measurements in a three-dimensional turbulent boundary layer developing on a yawed flat plate with two different leading edge configurations are presented, compared and discussed The autocorrelation function and the integral length scales obtained at several points within the boundary layer are described (Author)

**A79-13151** **Measurements in an axisymmetric turbulent boundary layer with weak and strong three-dimensional disturbances** H H Fernholz and J -D Vagt (Berlin, Technische Universitat, Berlin, West Germany) In Structure and mechanisms of turbulence I, Proceedings of the Symposium on Turbulence, Berlin, West Germany, August 1-5, 1977 Berlin, Springer-Verlag, 1978, p 222-233 19 refs

The paper investigates the turbulent boundary layer developing on a constant-radius blunt circular cylinder located axially in a uniform flow The cylinder forms the inner wall of an annulus whose outer wall is a porous metal cylinder An end plate at the exit of the 1 55-m long test section allows variation of the pressure gradient both in axial and in circumferential directions Nonuniformities in the spanwise distribution of skin friction and velocity in the viscous sublayer of the nominally axisymmetric turbulent boundary layer are observed just downstream of the elliptical nose cone used in the test Weak and strong disturbances are considered Attention is given to the strong effect of the axial and spanwise pressure distribution in the downstream part of the test section on skin friction, mean velocity, and Reynolds shear stresses S D

**A79-13155 Development of turbulence through non-steady boundary layer** Y Kobashi and M Hayakawa (Hokkaido University, Sapporo, Japan) In Structure and mechanisms of turbulence I, Proceedings of the Symposium on Turbulence, Berlin, West Germany, August 1-5, 1977 Berlin, Springer Verlag, 1978, p 277-288 10 refs

The paper examines the development of turbulence through the oscillating boundary layer of a flat plate in a wind tunnel in which the plate is driven sinusoidally along the flow It is found that a turbulent patch of free turbulence structure appears suddenly in a wave packet which soon after its occurrence adheres to the surface of the wall and starts to reorganize into a wall turbulence, thereafter, it grows just like the turbulent spot in a steady boundary layer, the main differences between the two being the regular appearance of the patch and its two-dimensional structure Space time correlation measurements point to the existence of large scale turbulence, whose most pronounced feature is the deformation of the eddy into an oblique structure when it travels through the transition region S D

**A79-13158 Experimental study of an asymmetric thermal wake** R Morel, M Awad, J P Schon, and J Mathieu (Lyon, Ecole Centrale, Ecully, Rhône, France) In Structure and mechanisms of turbulence II, Proceedings of the Symposium on Turbulence, Berlin, West Germany, August 1 5, 1977 Berlin, Springer-Verlag, 1978, p 36-45 7 refs Research supported by the Electricite de France

Results are presented for a wind-tunnel study of the asymmetric thermal wake generated in a symmetric kinematic field by heating only one side of a flat plate The longitudinal behavior of the profiles of mean velocity, mean temperature, turbulent intensities and turbulent fluxes is discussed The development of mean squared temperature which becomes negative in certain regions is examined It is shown that the distance between the axis of the kinematic wake and the position where temperature is maximum increases with increasing downstream separation, and that diffusion processes are important especially near the trailing edge A small region exists where the thermal flux is more linked to the large-scale structures than to the local temperature gradient S D

**A79-13173 The effect of shear layer instability on jet exhaust noise** C J Moore (Rolls-Royce, Ltd , Advanced Research Laboratory, Derby, England) In Structure and mechanisms of turbulence II, Proceedings of the Symposium on Turbulence, Berlin, West Germany, August 1-5, 1977 Berlin, Springer-Verlag, 1978, p 254 264 6 refs

Evidence for the variation of the broadband noise of a jet by modification of the large-scale instability wave structure in the shear layer is presented The objective is to provide a new insight into the jet noise mechanism which could account for some of the current jet exhaust noise anomalies Attention is given to a discussion of the large-scale jet structure, the behavior of broadband noise, and the location of broadband noise source The broadband noise from the excited jet appears to come from the same position at all frequencies Sufficient evidence exists to show that the large-scale structure of a jet is important in the mixing noise generation mechanism, not as a direct radiator of acoustic energy, but because of the turbulent stresses generated by the vortex interaction The strongest evidence is that the broadband noise can be modified by changing the strength of the structure S D

**A79-13180 Density changes and turbulence production in the expansion or compression of a turbulent flow at supersonic speed** J P Dussauge, J Gaviglio, and A Favre (Aix-Marseille I, Université, Marseille, ONERA, Paris, France) In Structure and mechanisms of turbulence II, Proceedings of the Symposium on Turbulence, Berlin, West Germany, August 1 5, 1977 Berlin, Springer Verlag, 1978, p 385-395 10 refs

Turbulence production in supersonic compressible flows subjected to acceleration or deceleration is studied According to physical considerations, turbulence production is separated into three parts isovolumetric production, enthalpic production, and dilatation production The effect of each production part on turbulent energy and on Reynolds stresses is assessed Furthermore, the three production parts are numerically compared for two cases a compressed shear layer for which isovolumetric production prevails, and an expanded shear layer for which the dilatation and enthalpic productions prevail S D

**A79-13200 Better utilization of SAR dynamic range** E J Dragavon (Hughes Aircraft Co , Culver City, Calif ) In Human Factors Society, Annual Meeting, 21st, San Francisco, Calif , October 17 20, 1977, Proceedings Santa Monica, Calif , Human Factors Society, Inc , 1977, p 235 240 7 refs

Improvement of the dynamic range capacities of display media in a single stimulus dimension will not improve utilization of the synthetic aperture radar (SAR) dynamic range Rather, the problem is one of selecting the most useful portion(s) of the SAR dynamic range in terms of relevant information content and mapping that data onto the available dynamic range of the display medium In the present paper, three general classes of image enhancement techniques for SAR video were studied through non real time computer simulation The general categories were monochromatic adaptive gray shade transformations pseudocolor encoding, and feature analytic methods The class of feature analytic methods was found to have the greatest potential for improving the operational utility of SAR imagery V P

**A79-13201 Enhancement of radar imagery by maximum entropy processing** C E Mancill (Hughes Aircraft Co , Culver City, Calif ) In Human Factors Society, Annual Meeting, 21st, San Francisco, Calif , October 17-20, 1977, Proceedings

Santa Monica, Calif , Human Factors Society, Inc , 1977, p 241-243

The maximum entropy spectrum (MES), a sampled data power spectrum estimator, is applied to the enhancement of imagery obtained by synthetic array radar (SAR) imaging systems MES offers better frequency resolution than conventional Fourier transform methods for certain signal classes Since azimuth ground resolution in SAR systems is obtained by Doppler frequency measurement of the radar return, the method is capable of enhancing the resolution of SAR maps The principal signal requirement is adequate signal-to-noise ratio The maximum entropy method has been tested using data obtained by the Hughes FLAMR radar system The super-resolution capabilities of the method are demonstrated using FLAMR images of corner reflector arrays (Author)

**A79 13220 The air combat maneuvering range /ACMR/, a new approach to aircrew training** J M Ketchel (SRI International, Menlo Park, Calif ) In Human Factors Society, Annual Meeting, 21st, San Francisco, Calif , October 17-20, 1977, Proceedings Santa Monica, Calif , Human Factors Society, Inc , 1977, p 421 425

The ACMR/I system discussed in the present paper was developed to improve aircrew training in air combat maneuvering, by combining actual flying with instrumentation to provide both realism and objective measurement The system provides realistic missile simulations while flying ACM, immediate knowledge of results of missile shots and envelope entry or exit, objective measurement of

maneuvering performance, capability for trainees to observe their own performance, and to document and track their own progress, means of effective collaboration between airborne and ground instructors during training sessions, and means of establishing objective norms and performance criteria In addition to these training advantages, the ACMR/I system is well suited for the operational testing and evaluation of new aircraft and weapon systems V P

**A79 13227 International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings (Colloque International sur les Systemes Electroniques d'Aide à la Navigation Aérienne, Paris, France, November 14-18, 1977, Proceedings)** Conference sponsored by the Secretariat d'Etat aux Transports, Direction Generale de l'Aviation Civile, Direction des Industries Electroniques et de l'Informatique, et al Paris, Federation des Industries Electriques et Electroniques 1977 341 p In French and English $20 92

Papers are presented on the automation of air traffic control, the operational requirements of general aviation, and radio electric pollution of air navigation aids Consideration is given to the development of FAA advanced systems, the application of advanced flight-path prediction techniques to air traffic control, and the development of distance measuring equipment A simple integrated navigation system based on VOR and DME is described along with Loran C and the application of the Omega system to air navigation The use of satellites for aviation mobile services, a spread spectrum navigation receiver, the design of warning systems, and the development of surveillance and control systems are described Various types of landing systems are reviewed and attention is given to an electronically scanned Tacan antenna and an all solid-state Tacan beacon S C S

**A79 13232 Adaptation of electronic aid systems to the requirements of air traffic controllers (L'adaptation des systemes d'aide electronique aux besoins des contrôleurs du trafic aerien)** J Y Valin (Centre d'Etudes de la Navigation Aerienne, Orly Aerogare, Val de Marne, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 23 25 In French

The diverse tasks of the air traffic controller are briefly outlined Recommendations are made for adapting electronic aids, particularly display systems, to controller needs Suggestions are also made for reducing controller workload by dividing the tasks among several operators and adjusting the flow of heavy air traffic S C S

**A79-13234 Ground-air and air ground communications links - Voice and data link in different systems (Charge en communications sol-air et air-sol Phonie et data link dans les différents systemes)** L Milosevic (Thomson CSF Division Systemes Electroniques, Bagneux, Hauts de Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 31 40 In French

Ground-to air and air to ground communications are discussed noting those which require voice transmission and those which may be effected via automated processes Three types of systems are described (1) secondary surveillance radar techniques (noting VOR DME, and a VHF data link), (2) an ADSEL/DABS system, and (3) an integrated SINTAC system The operation, transmission parameters, and capacities of each system are considered S C S

**A79-13241 Theory and experiments on precision L band DME** F Chiarini (Fabbrica Apparecchiature per Comunicazioni Elettriche Standard, Laboratorio Centrale, Pomezia, Italy), G Falciasecca (Centro Onde Millimetriche, Bologna, Italy), and D Graziani (Fabbrica Apparecchiature per Comunicazioni Elettriche Standard, Milan, Italy) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 83 88 6 refs

A preliminary report is given on the studies and the experiments conducted on the problems of increasing the accuracy on the present distance measuring equipment system for enabling the use with MLS The studies made on the multipath errors suggested the use of a computer adopting a model which includes the area, the airport and the receiver model A mathematical expression of the receiver model is given Separate mathematical calculations demonstrate that the adoption of the averaging in the measurement does not give advantages nor improvements in the accuracy The relationship between shape and frequency spectrum of a pulse has being analyzed For the purpose mention is made of a pulse synthesizer built with the aim of facilitating the generation of special pulse shapes Some examples of the results of these investigations are given (Author)

**A79-13242 A simple integrated navigation system on VOR-DME basis** K Fricke and H Hurrass (Deutsche Forschungs- und Versuchsanstalt fur Luft und Raumfahrt, Institut fur Flugfuhrung, Braunschweig, West Germany) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings
Paris, Federation des Industries Electriques et Electroniques, 1977, p 89 94 5 refs

VOR and DME are used today for short range navigation Since digital computers have been relatively cheap for some time, and since they will become even cheaper in future, such computers should also be installed in the smaller types of aircraft Thus the navigation accuracy could be improved by the integration of VOR/DME and onboard navigation systems In this lecture, Doppler radar and heading, as well as true air speed (TAS) and heading, are treated as onboard navigation systems Both systems have been tested by the DFVLR in Braunschweig The integration was carried out by a Kalman filter A DO 28 and a HFB 320 were used as measuring aircraft The navigation error of the whole system is 33 percent to 50 percent of the VOR/DME position error (Author)

**A79-13243 Loran C as an international aid to navigation** J P Van Etten (ITT, ITT Avionics Div, Nutley, N J) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings
Paris, Federation des Industries Electriques et Electroniques, 1977, p 95 102 11 refs

Loran C is recognized today as a leading candidate to satisfy international aid to navigation requirements This paper reviews applications and navigation requirements of marine, airborne and land users It summarizes the fundamentals of the Loran-C system, reviews early Loran C system and equipment drawbacks and limitations, particularly for airborne use, and evaluates the impact of system and technology improvements that have been accomplished in the last decade A typical modern Loran C airborne navigation equipment is described Finally, the paper examines the only significant technical impediment to global acceptance of Loran-C as an international aid to navigation and summarizes the positive actions in process to deal with this problem (Author)

**A79-13244 Implementation of the Omega system for air navigation (L'exploitation du reseau OMEGA pour la navigation aerienne)** C Jaeger (Crouzet, Valence Drome, France) and G Nard (Sercel, Carquefou, Loire Atlantique, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings

Paris, Federation des Industries Electriques et Electroniques, 1977, p 103 109 In French

The development of the Omega air navigation system is outlined and the basic principles of operation are discussed noting the locations of the eight Omega ground stations The equipment and techniques used for processing Omega signals are described with

reference to antenna parameters and corrections for propagation effects The present status of Omega equipment is discussed and recommendations are made for future developments S C S

**A79-13245 Precision DME at L-band using phase-coded transmission** K Kelly, F G Overbury, and A Lang (Standard Telecommunication Laboratories, Ltd , Harlow, Essex, England) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Elec troniques, 1977, p 111 116 Research supported by the Civil Aviation Authority

Precision distance measuring equipment (PDME) is outlined noting that the substructure of the proposed pulse contains a binary code modulated onto the RF carrier by simple differential phase shift keying The PDME system accommodates 200 channels by using 100 NAV-DME frequency allocations and two airborne interrogation codes Attention is given to the effects of PDME transmissions on the NAV-DME ground transponder and on NAV DME/Tacan airborne interrogators The influence of NAV-DME transmissions on a representative PDME receiver is also evaluated S C S

**A79-13247 *Considerations on the airborne use of* DME interrogators or SSR transponders for ground derived landing and surveillance systems** G Hofgen (Standard Elektrik Lorenz AG, Stuttgart, West Germany) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, Novem ber 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 121-125

Recent developments in various countries have been showing a tendency to employ the SSR transponder as the airborne part of ground derived monitoring and surveillance systems The DLS, on the other hand, is based on the use of the airborne DME The paper discusses pros and cons of both approaches Starting from the fundamental difference of both types of equipment one being used for ATC and the other for navigation - technical properties and growth potential of them is analyzed After discussing the basic operational requirements, a comparison of all relevant features of both approaches will be made The paper concludes with an assessment of their capabilities with regard to landing and surveillance systems (Author)

**A79-13248 Design of a spread-spectrum navigation receiver /Navstar/** C R Cahn and E H Martin (Magnavox Government and Industrial Electronics Co , Advanced Products Div , Torrance, Calif ) In International Conference on Electronic Naviga tional Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Indus tries Electriques et Electroniques, 1977, p 127 134 10 refs

Spread spectrum modulation provides significant advantages for a satellite based passive navigation system, such as the Navstar Global Positioning System Reception and appropriate processing of time-synchronized spread spectrum signals from four satellites in known orbits enables a user to derive continuous position and velocity fixes in three dimensions, along with a real time clock calibration The benefits of the spread spectrum modulation are single frequency allocation via spread spectrum multiple access, precision ranging measurement on the code modulation, multipath discrimination, and processing gain against interference This paper discusses some of the design considerations for implementing a time-sequenced navigation receiver intended for low cost avionic and other applications (Author)

**A79-13250 Man-machine interface (Interface homme-machine)** M Legrand (Thomson CSF, Issy les-Moulineaux, Hauts-de-Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 141-146 In French

The problem of the man-machine interface for aircraft of growing complexity is discussed New possibilities opened up to pilot in the way of new displays and control instruments which lessen his work load and provide him better communication with the machine are described P T H

**A79-13251 Onboard navigation and flight control integrated system architecture (Architecture d'un système integré de pilotage et navigation embarqué)** J Y Begeault (ISPENA, Paris, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 147-155 In French

The paper presents the architecture of an integrated Navigation and Guidance System This system will be flight tested in 1979 The integration concept has been defined and the level of utilization of digital processors, multiplex buses and electronic displays chosen The data processing partitioning and the boxes interconnect principles based on the use of multiplex buses and of concentrating units have an influence on the system architecture A mix of electronic (head-up and head-down displays) and conventional electromechani cal instruments is used to interface the integrated system and the crew Flexibility has been introduced in the system design allowing easy adaptation, throughout the aircraft operational life, of different system requirements or new technologies (Author)

**A79-13252 Considerations on the design of warning systems** A Vanderschraaf (Fokker VFW, Schiphol Airport, Netherlands) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceed ings Paris, Federation des Industries Electriques et Electroniques, 1977, p 157-159

Present day warning systems are described noting that it is unrealistic to expect pilots to analyze all warnings, irrespective of their expressly designated significance, at critical phases of the flight Recommendations for alleviating this problem are made including (1) a multiple-light solution with four modes of urgency, and (2) the phase-adapted warning system (PAWS) in which a computer is employed to assess the relative urgency of a warning in relation to the phase of the flight S C S

**A79-13254 Flight and navigation instruments for general aviation (Les equipements de pilotage et de navigation de l'aviation générale)** M Vittecoq (Badin-Crouzet, Buc, Yvelines, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 167-169 In French

The numerous restricted areas on the territory of France and the existing complicated procedures even under VFR (visual flight rule) conditions necessitate the development of adequate instruments to enhance expansion of general aviation The current status of general-aviation autopilots, basic flight instruments, and radio navigation equipment is reviewed, and developments in these fields are noted V P

**A79-13257 FAA's development program for Aircraft Separation Assurance /ASA/** S B Poritzky (FAA, Washington, D C ) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceed ings Paris, Federation des Industries Electriques et Electroniques, 1977, p 185-191

The aim of the program discussed in the present paper is to develop and integrate effective ASA concepts as a means of reducing risk Since limitation of risk cannot be achieved by airborne collision avoidance systems alone, FAA's Automatic Traffic Advisory and Resolution Service (ATARS) has introduced new concepts, such as Terminal Control Areas, Radar Sequencing, and Separation Service for VFR aircraft, lowering of Positive Control Airspace to 18,000 feet, and requirements for carriage of Mode C transponders and encoding altimeters in aircraft operating above 12,500 feet FAA has implemented the Conflict Area service en route, has extended surveillance system coverage, and is in the process of developing

three DABS/IPS systems Several independent collision avoidance systems have been flight tested and evaluated V P

**A79-13258 Collision avoidance in an integrated system I - Advantages of the capability (Anticollision dans le système intégré I - Intérêt de la fonction)** L Milosevic (Thomson-CSF, Division Systemes Electroniques, Bagneux, Hauts-de Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 193 198 In French

The paper reviews the problems presented by collision avoidance and the responsibilities of the pilot and the air traffic controller as a function of the flight configuration It discusses the procedures, information exchanges, necessary equipment as well as the general principles within an integrated system Two types of emissions are described periodic emissions during the surveillance and warning phase, and bilateral exchanges in case of possible danger of collision These exchanges are needed to determine the exact conditions of the crossing The detailed messages, the transmission time slots, the range and the system capacity for both phases are given The problems of the moment of decision, the time of access to communications as well as the synchronization between aircraft are examined The operational use of the system and the split of the responsibilities between pilot and controller are discussed (Author)

**A79-13259 Collision avoidance in the integrated system II - Characteristics (Anticollision dans le systeme integre II - Caracteristiques)** L Milosevic and M Doux (Thomson CSF, Division Systemes Electroniques, Bagneux, Hauts-de Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 199-204 In French

The described collision avoidance system establishes a two way connection between the two approaching aircraft and permits calculation of the closest point of approach (CPA) and the time to the CPA In the case that danger of collision is indicated, an avoidance maneuver, construed in a horizontal plane, is planned, and the resulting distance separating the aircraft is determined as a function of the CPA and the time to CPA Errors in these two parameters at the time of decision for the avoidance maneuver are discussed in terms of the systematic and random errors made in the measurement of the distance separating the aircraft Continuous control of the maneuver allows possible correction and, if necessary, a decision as to maneuvering in the vertical plane Data on the positions of other aircraft in the vicinity are transmitted at a slower rate M L

**A79-13260 Cat III landing operations at Air Inter (Les operations de Categorie III a Air Inter)** A Roland Billecart (Air Inter, Orly Aerogare, Val de Marne, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 205 208 In French

The paper reviews Cat III landing experience at Air Inter obtained with three different systems Caravelle III and XII, Mercure, and the A 300 B Airbus Maintenance considerations for Cat III are discussed, and attention is given to operational experience with Cat III for a typical day of Air Inter flights Landing success statistics are presented for Caravelle XII and Mercure B J

**A79-13261 Coupling of ILS and inertial data in all weather approach and landing operations (Traitements et filtrages des informations inertielles et ILS en vue d'assurer l'atterrissage tous temps)** P Lloret (Societe d'Applications Generales d'Electricite et de Mecanique, Paris, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 209 212 In French

The LIS 30 digital system is described, which processes ILS data (LOC and GLIDE deviations), inertial data (North and East components of ground speed) and radio altitude, in order to provide distance from aircraft to GLIDE emitter and filtered or extrapolated lateral deviation The computer is inserted between the ILS receiver and the autopilot No change is required in the transfer functions of the autopilot The main characteristics of the filtered lateral deviation provided by the computer are (1) a good attenuation of the ILS beam distortions (2 5 at least, and up to 5 or 7 for very poor ILS beams), and (2) the extrapolation of the LOC signal, in case it disappears, during a time period which warrants a safe landing when ILS loss occurs under the 100 feet height The system described in this paper has been flight tested, particularly on board the A 300 B (Author)

**A79-13262 System for confirming ILS or MLS for Cat III type landing without decision height (Système de confirmation de l'ILS ou du MLS pour atterissage CAT III sans hauteur de decision)** R Strauch and M Riffiod (Telecommunications Radioelectriques et Telephoniques, Le Plessis Robinson, Hauts de-Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Elec troniques, 1977, p 213 222 In French

The paper describes a confirmation system which determines the lateral deviation in meters from the runway centerline when the aircraft is within a space centered at 30 meters of the ILS axis A standard onboard FM/CW radio altimeter is linked with two ground based beacons which measure the angular deviation and transmit it back to the aircraft Multiplying by the altitude of the altimeter yields the lateral deviation In flight tests show that the rms accuracy of lateral deviation measurements is 1 meter over a plus or minus 20 meter lateral range B J

**A79-13263 MLS in the United States** S B Poritzky (FAA, Washington, D C ) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 223 230

The paper deals with some aspects of the development of the Microwave Landing System (MLS) in the USA It is shown how the Time Reference Scanning Beam (TRSB) MLS developed from the combined effort of a comprehensive development program and a competitive selection process in which the TRSB technique emerged as technically superior to the Doppler system Testing and evaluation showed that the TRSB MLS meets all the FAA and ICAO statements and requirements V P

**A79-13264 The AGDLS - A multipurpose system for in-flight evaluation of new ATC techniques (L'AGDLS - Systeme multi-fonction pour l'evaluation en vol des nouvelles techniques de contrôle du trafic)** A Michel (Service Technique de la Navigation Aerienne, Paris, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 231-240 In French

The AGDLS (Air Ground Data Link System) discussed in the present paper was initially developed for studying p oblems asso ciated with data uplinks and downlinks and problems associated with guidance in the approach to landing The system has been subsequently used to perform such ATC functions as communication, surveillance, and navigation The superiority of the AGDLS over other existing systems is noted The application of the system to the evaluation of an aircraft in flight environments arising in ATC is demonstrated V P

**A79-13265 Expansion of the 960 to 1 215 MHz band use - Aspects, achievements, goals** M Bohm (Standard Elektrik Lorenz AG, Stuttgart, West Germany) In International Conference on

Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 241-246 6 refs

Methods for increasing function density in allocated frequency bands are discussed with reference to described SETAC, DLS, and SEFAN systems The integration of communication, navigation, and identification systems to form ICNI systems for mobile and aviation users is considered Examples of wasteful use of available frequencies are noted, and techniques for increasing the efficiency of frequency band use are considered M L

**A79-13266 Integrated communication, navigation and identification in the 1980's and beyond using low duty distributed time-frequency-phase code technology** J B Kennedy (ITT, ITT Avionics Div, Nutley, N J) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 247 251

The development of integrated communication, navigation, identification systems is discussed noting low-duty pulse technology, spread-spectrum methods, and frequency hopping techniques It is shown that low duty time-frequency phase code division multiple-access technology, which uses low-duty pulse signals distributed in time and frequency- and phase code, permits high levels of operational and functional procedures, multipath access, and signal protection The technology is applicable to interconnected mobile platforms such as ships, aircraft, tanks, and missiles S C S

**A79-13267 Integrated navigation, traffic control, collision avoidance and communication system SINTAC-C2 (Systeme integré de navigation, contrôle du trafic, anticollision et communications - SINTAC-C2)** L Milosevic (Thomson-CSF, Division Systemes Electroniques, Bagneux, Hauts de Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings
Paris, Federation des Industries Electriques et Electroniques, 1977, p 253 268 In French Research supported by the Service Technique des Telecommunications de l'Air and Direction des Recherches, Etudes et Techniques

The civil aviation SINTAC-C2 system, an integrated system for navigation, traffic control, collision avoidance, and communication, is described Spread spectrum modulation permits a high degree of discrimination for the localization function and a high data output rate as well as a fast access time in a frequency band as narrow as possible for the total amount of communication The integrated system uses an omnidirectional antenna for the ground stations, synchronous transmissions (alternating ground stations and aircraft), the 3 R process for localization, and time organized transmissions for the ground stations, direct random access transmission capability is reserved for airborne initiative The system is not compatible with the presently used system M L

**A79-13268 The wake Vortex Advisory System** J N Hallock, W D Wood, and E A Spitzer (U S Department of Transportation, Transportation Systems Center, Cambridge, Mass ) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 269 273

The vortices from over 50,000 landing aircraft have been monitored at Kennedy, Stapleton, O'Hare, and Heathrow International Airports Using this data base, a wind criterion has been defined which can be used as a vortex condition indicator, by measuring the wind velocity in the runway approach zone and comparing the velocity with the wind criterion, the times when the aircraft spacing may be reduced safely to three nautical miles for all aircraft are delineated A Vortex Advisory System has been implemented at the Chicago O'Hare International Airport and will be fully operational in December 1977 (Author)

**A79-13269 New-generation Tacan equipment (Nouvelles générations de matériels TACAN)** J C Joguet (Le Materiel Télephonique, Boulogne-Billancourt, Hauts-de Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 275-279 In French

The paper reviews such advances in navigation equipment as the use of programmed-logic (i e microprocessor) processing of video signals and the utilization of UHF power transistors For Tacan, the changeover from wired logic to programmed logic will result in the following improvements (1) effective data smoothing by means of self adaptive control loops, and (2) RNAV computations The software is divided into four parts three for the actual processing (azimuth, distance, and navigation) and one a control monitor part for the various operating modes The main advantage of the new transistorized equipment is the considerable reduction in power dissipation, making forced air cooling unnecessary B J

**A79-13270 Sea-air rescue and offshore aerial navigation using Loran C** L W Speelman (Teledyne Systems Co , Northridge, Calif ) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 281-287 8 refs

The work reported in the present paper shows that the Loran C system is a high accuracy navigation aid for offshore and air rescue operations User hardware is now available to permit economical offshore operations, using a single RF navigation aid for en-route, terminal, and final approach phases of flight Overland uses of the system are rapidly becoming apparent Expansion of Loran coverage to meet increased signal coverage demands is presently assured Low cost data link equipment provides user flexibility in monitoring and recording flights to increase operation efficiency and safety V P

**A79-13271 Fail-soft output stage for navigation transmitters** D Graziani (Fabbrica Apparecchiature per Comunicazioni Elettriche Standard, Milan, Italy) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 289-291

The paper describes the use of four triodes in parallel to function as a fail-soft device for generating the (several kilowatt) L band power Deterioration of one or more triodes will reduce output power proportionately but will not affect other parameters such as the shape of the pulse and the frequency spectrum Advantages in using a few low-power devices instead of one high power device are considered, the four-triode design is reported, and the importance of the Tacan power amplifier for reliability is indicated M L

**A79-13272 Electronically scanned Tacan antenna** G Scherer (ITT, ITT Avionics Div , Nutley, N J ) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceedings
Paris, Federation des Industries Electriques et Electroniques, 1977, p 293-297

The Tacan antenna system and its performance are described The system, developed for shipboard use, is a high performance all-band lightweight unit complete with an integral monitoring system and built in fault location capabilities Electronic generation of bearing information overcomes bandwidth limitations inherent in mechanical rotating antennas, and electronic scanning of diode-controlled parasitic elements permits increased system performance and flexibility The system allows continuous monitoring of radiated signal quality as well as simple fault isolation and identification Overall antenna system azimuth accuracy of one degree is provided with a mast mounted antenna weight of less than 100 pounds M L

**A79-13273 * Development of a microwave multilateration system for VTOL landing guidance** C L Britt, Jr and S L Wheelock (Research Triangle Institute, Research Triangle Park, N C ) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceed ings Paris, Federation des Industries Electriques et Electroniques, 1977, p 299-306 Contracts No NAS1 12910, No NAS1-13707

An experimental microwave multilateration system has been developed by NASA to provide highly accurate position and velocity measurements during the approach and landing phase of VTOL aircraft The system uses an angle modulated ranging signal to provide both range and range rate measurements between an aircraft transponder and multiple ground stations Range and range rate measurements are converted to coordinate measurements, and the coordinate information is transmitted via an integral data link to the aircraft This paper describes the development of the multilateration system and the associated digital signal processing techniques Advantages and disadvantages of several processing techniques are discussed The operation and accuracy of the system as determined from both analytical studies and flight experiments will be described (Author)

**A79-13274 Spread spectrum modulation I - Benefit resulting from application to an integrated system (Modulation a étalement du spectra I - Interêt d'application au systeme integre)** L Milosevic (Thomson CSF, Division Systemes Electroniques, Bagneux, Hauts-de-Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Electroniques, 1977, p 307 311 In French

Characteristics of spread spectrum modulation are discussed and compared to baseband modulation characteristics The advantages of spread spectrum modulation for civilian systems, in particular in applications in an integrated system, are examined with attention to reliability, efficient use of the overall frequency band, reduction of ambiguity 'areas', and the use of the same modulation for localiza tion and communications Spread spectrum modulation protects against interference and multipath, and its high discrimination ability provides higher channel capacity when the random access procedure is used M L

**A79-13275 Spread spectrum modulation II - Characteristics (Modulation a étalement du spectre II - Caracteristiques)** C Sinnassamy, P Laurent, M Vandroux, and J C Charavit (Thomson CSF, Division Systemes Electroniques, Bagneux, Hauts de Seine, France) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14 18, 1977, Proceed ings Paris, Federation des Industries Electriques et Electroniques, 1977, p 313 319 In French

The main characteristics of the PSK/PN and MSK modulations are given signal format, spectra, low response from filters outside the band, and separation as a function of frequency The following curves are discussed usable number of codes according to their intercorrelation, error rate as a function of the signal/noise ratio as a function of the level of interference, the nonacquisition probability versus the admissible false alarm rate Finally, the comparative curves between binary and M ary modulation are given (Author)

**A79-13276 The AN/ARN-132 Navstar navigator** L J Jacobson and R Eastwood (Magnavox Government and Industrial Electronics Co , Advanced Products Div , Torrance, Calif ) In International Conference on Electronic Navigational Aid Systems for Aircraft, Paris, France, November 14-18, 1977, Proceedings Paris, Federation des Industries Electriques et Elec troniques, 1977, p 321-326

The paper describes characteristics of the AN/ARN-132 aircraft navigation equipment designed for incorporation in USAF aircraft to permit use of the Navstar Global Positioning System The AN/ARN-132 equipment is a preproduction prototype, and topics considered include its design-to-cost goals, system architecture tradeoffs, mechanical design features, hardware module tradeoffs, and software tradeoffs The equipment is designed to meet the basic navigation requirements at the minimum life cycle cost The main life cycle cost savings features are single frequency operation, C/A code operation only, and single channel sequential satellite acquisition and tracking M L

**A79-13277 Multifunctional potentials of present-day radio navigation systems (Les possibilités multifonctionnelles des systemes actuels de radionavigation)** J Bertrais (Federation des Industries Electriques et Electroniques, Paris, France) *Colloque International sur les Systemes Electroniques d'Aide a la Navigation Aerienne, Paris, France, Nov 14-18, 1977, Paper* 6 p In French

The paper proposes a technique for combining several radio navigation functions (aircraft detection, air traffic control, collision avoidance, etc ) into one system Existing systems differ only in the information processing technique and in the carrier frequency The proposed technique would locally extract this information, convert it into a 'fictive' frequency suitable for processing, and thus combine the advantages of existing systems In other words, an aircraft can receive the signal, extract the information, and process it as needed Mobile position lines are created and used to sequentially interrogate aircraft in the area B J

**A79-13295 Calculation of the flow with separation for airfoils and multi-element airfoil systems placed in proximity of the ground or in closed tunnels (Berechnung der Stromung mit Ablosung fur Profile und Profilsysteme in Bodennahe oder in geschlossenen Kanalen)** D Steinbach (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Stromungsmechanik, Gottingen, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung*, vol 2, Sept-Oct 1978, p 293-305 28 refs In German

A method is described for the calculation of the incompressible flow with simple rear separation for airfoils and multi-element airfoil systems placed in proximity of ground or in closed tunnels The method consists of two parts, namely the calculation of the potential flow including a model flow for a dead air, based on a surface singularity method and the calculation of the profile boundary layers by an integral method With the aid of the principle of reflection the effects of the ground and the tunnel walls are taken into account The method is primarily applied to such profile configurations where the profile flow is partly separated The calculations show that there exists a close relation between wall influence and flow separation and that for this interaction the Reynolds number becomes an important quantity (Author)

**A79-13296 Viscous transonic flows about 3-D wings** W Kordulla (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur angewandte Gasdynamik, Cologne, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung*, vol 2, Sept-Oct 1978, p 306-312 18 refs

A finite-difference solution for Prandtl's boundary-layer equations is combined with the transonic small-disturbance relaxation solution of Bailey and Ballhaus for inviscid flows in order to include viscous effects in the prediction of pressure and lift distributions on finite 3-D wings The inviscid-viscous interaction is modeled by means of the displacement surface which can be thought of as the effective body surface seen by the inviscid oncoming flow Displacement thickness, lift and pressure distributions resulting from the combined solution are presented for transonic flows about the RAE 101 A wing and a Lockheed transport wing, both at small angles of attack Lift and pressure distributions are compared with experimental values The influence of changing arbitrarily the start of laminar-turbulent transition on displacement surface, lift and pressure distributions is discussed for the flow about the RAE 101 A wing (Author)

**A79-13367 Distributed time division multiple access /DTDMA/ - An advanced communication technique with application to CCC and integrated CNI** J Rubin (ITT, Avionics Div , Nutley, N J ) In NTC '77, National Telecommunications Conference, Los

Angeles, Calif , December 5-7, 1977, Conference Record Volume 3 New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 35 6-1 to 35 6-5 Contract No N62269-76-C-0105

The DTDMA concept is based on the premise of maximizing the full utility of time, frequency, and code This multidimensional approach contributes to efficient multiple access, antijamming, and low probability of intercept system solutions The utility of the DTDMA technique is shown in its application to a CCC/ICNI (Command, Control, Communication/Integrated Communication, Navigation, Identification) system This is highlighted in the common information medium (band/channel) usage of a large number of 'statistically orthogonal' time-frequency-phase code cell patterns It is shown that a large number of CCC/ICNI users can simultaneously and independently access the information channel with an acceptably low probability of mutual interference B J

**A79-13664 A systematic procedure for generating useful conformal mappings** D A Caughey (Cornell University, Ithaca, N Y ) *International Journal for Numerical Methods in Engineering,* vol 12, no 11, 1978, p 1651-1657 14 refs

The paper outlines a method for generating the conformal transformation which maps a geometry with boundary containing a limited number of high curvature regions to a near rectangle, or, in the case of infinite domains, to an infinite or semi-infinite strip of slowly varying width The method is based on the standard Schwarz-Christoffel technique and makes use of an auxiliary half-plane Two examples are presented The first is a derivation of the mapping suggested by Caughey and Jameson (1976) for use in calculating transonic flow past an airfoil in a wind tunnel, the second is a recently devised mapping to treat the geometry of an axisymmetric inlet nacelle with a blunt center hub P T H

**A79-13672 *Cross-country sailplane flight as a dynamic* optimization problem** B L Pierson (Iowa State University of Science and Technology, Ames, Iowa) and J L De Jong (Eindhoven, Technische Hogeschool, Eindhoven, Netherlands) *International Journal for Numerical Methods in Engineering,* vol 12, no 11, 1978, p 1743-1759 16 refs Research supported by the Iowa State University of Science and Technology

A minimum time, thermal-to-thermal sailplane trajectory optimization problem is formulated as a nonlinear optimal control problem Numerical solutions are obtained using a gradient projection algorithm which incorporates conjugate directions of search Further insight into the nature of the solutions and the computational process is obtained through an analysis of the linearized sailplane dynamics and the necessary conditions for optimality Numerical results are presented for two sailplane types and various values of thermal strength and distance between thermals An additional problem is formulated and solved for the case of bounded control rate (Author)

**A79-13944 Optimization of body shape at small Reynolds numbers** A A Mironov *(PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki,* Jan Feb 1978, p 87 93 ) *Journal of Applied Mechanics and Technical Physics,* vol 19, no 1, July 1978, p 70-74 6 refs Translation

In the present analysis, the optimality conditions for a profile in Stokes flow are written in the form of an expansion in series of the Reynolds number, treating the latter as a small parameter Boundary value problems for determining small corrections to the optimal configuration obtained in the Stokes approximation are formulated It is shown that a profile which is optimal in the Stokes approximation remains optimal at small Reynolds numbers, provided only the first terms are taken into consideration in the corresponding expansions V P

**A79-13955 A probability estimate of the long-term strength of aviation gas-turbine rotor blades** A N Vetrov (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian SSR) *(Problemy Prochnosti,* Mar 1978, p 25 29 ) *Strength of Materials,* vol 10, no 3, Nov 1978, p 274-280 8 refs Translation

The method proposed in the present paper for calculating the time to failure of gas-turbine rotor blades under random static loads is based on a probabilistic treatment of the hypothesis of linear fatigue damage accumulation The method is illustrated by calculating the service life of rotor blades for an actual gas turbine V P

**A79-13975 # Fundamentals of the electrical equipment of flight vehicles Parts 1 & 2 (Osnovy elektrooborudovaniia letatel' nykh apparatov Parts 1 & 2)** D E Bruskin, N T Koroban, V T Morozovskii, I M Sindeev, and V A Shumikhin Moscow, Izdatel' stvo Vysshaia Shkola, 1978 Pt 1, 304 p , pt 2 280 p 54 refs In Russian

The first part of the book deals with the general aspects of the electrical equipment of aircraft, helicopters, winged rockets, and guided and nonguided missiles The electrical circuits and power supplies are examined, along with the automatic current frequency and voltage control for aircraft dc and ac generators Means of providing in-phase operation of dc and ac generators are discussed The second part is focused on power transmission and distribution systems, auxiliary power sources, electric drives, and gas turbine engine starting systems Attention is given to aircraft lighting systems and to means of providing reliable operation of electrical equipment V P

**A79-13976 # Oscillating airfoils II - Newtonian flow theory and application to power-law bodies in hypersonic flow** R M Barron (Windsor, University, Windsor, Canada) and P Mandl (Carleton University, Ottawa, Canada) *AIAA Journal,* vol 16, Nov 1978, p 1132-1138 10 refs

A theoretical investigation of the hypersonic flow past two-dimensional airfoils oscillating with arbitrary frequency is undertaken An unsteady Newtonian flow theory is developed which includes the contributions due to centrifugal force by considering gasdynamic theory in the limit where gamma tends to unity and freestream Mach number tends to infinity The theory is valid for both sharp- and blunt nosed curved bodies, provided the shock wave remains attached at the nose The case of airfoils supporting power-law shocks and pitching about a pivot on its axis of symmetry is examined in light of this theory It is seen that pivot positions ahead of h = (3 m 1)squared/9 times m square (m = power law exponent) tend to destabilize the airfoil, while those behind it have a stabilizing effect (Author)

**A79-13978 # Experimental investigation of noise reduction from two parallel-flow jets** W V Bhat (Boeing Commercial Airplane Co , Seattle, Wash ) *(American Institute of Aeronautics and Astronautics, Aeroacoustic Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1290 ) AIAA Journal,* vol 16, Nov 1978, p 1160-1167

The acoustic characteristics of two parallel-flow jets have been investigated as a fundamental study aimed at understanding jet noise suppression mechanisms Model-scale tests were conducted in an anechoic environment Acoustic measurements were made in the plane containing the axis of the two jets using a far-field microphone array The effect of tube geometry was studied with the same flow through both tubes The effect of flow parameters was investigated using twin coplanar jets Detailed acoustic test results were evaluated in terms of engineering and subjective units The following general conclusions were drawn (1) two coplanar parallel-flow jets with dissimilar unmixed flow can be quieter than an equivalent fully mixed single-flow jet, (2) two parallel-flow jets with the same flow can be up to 3 dB quieter than the equivalent single-flow jet, (3) two parallel-flow jets become quieter when lateral spacing is reduced, the nozzle near the observer is staggered upstream, or a smaller nozzle is placed near the observer, and (4) for two parallel-flow jets with dissimilar flows, the noise at 90 to 110 deg from the inlet axis depends mainly on the peak jet velocity, and noise at 120 to 160 deg depends very strongly on only that part of velocity profile which the observer can 'see' directly (Author)

**A79-13979** # **Nonlinear unsteady potential flow calculations for three-dimensional oscillating wings** W Geissler (Aerodynamische Versuchsanstalt, Gottingen, West Germany) *AIAA Journal*, vol 16, Nov 1978, p 1168-1174 14 refs

A numerical method is presented for calculating the steady and unsteady pressure distributions on oscillating three dimensional wings of arbitrary planform and thickness in incompressible flow for a variety of oscillation modes and frequencies The real surface is represented by a source-sink distribution as well as by a doublet distribution, the doublet emanates from the trailing edge into the wake of given geometry The kinematic boundary condition is fulfilled on the real wing surface The doublet strengths are determined by applying the Kutta condition at the trailing edge of the wing Results obtained by this method are compared with existing mean surface theories and experimental data The results point to the significance of the effects of the wing thickness and steady mean angle of incidence The boundary-layer correction shows clearly the major effects of viscosity, particularly in the trailing edge region of the wing S D

**A79-13980** # **Aerodynamic forces in finite wings in oscillatory flow - An experimental study** M H Patel (University College, London, England) *AIAA Journal*, vol 16, Nov 1978, p 1175-1180 11 refs Research supported by the Ministry of Defence (Procurement Executive)

This report describes aerodynamic lift and pitching moment measurements on finite wings in oscillating vertical gusts of varying frequency parameter and gust amplitude A set of six conventional wings with varying aspect ratio, sweep angle, and taper are tested The results show that the variation of aerodynamic force per unit gust amplitude with frequency parameter is independent of free-stream velocity, wing incidence, and gust amplitude but is considerably influenced by wing sweep These experimental results are compared with a lifting surface theory for two of the test planforms and show good agreement The effect on the aerodyamic forces of allowing free transition on the wing surfaces is also investigated (Author)

**A79-13982** # **Optimum operating techniques of two-state hypersonic gun tunnel** T Kimura, C Kuwate (Kobe University, Kobe, Japan), and Y Nadai *AIAA Journal*, vol 16, Nov 1978, p 1185-1188 13 refs

An operating technique of a two-stage hypersonic gun tunnel is presented The two-stage gun tunnel differs from a conventional gun tunnel in that a free-piston compressor is used as a high-pressure source Although the free-piston technique has previously been applied successfully to ballistic ranges, shock tubes, and shock tunnels, it has been difficult to adapt it to operate a gun tunnel In this paper, an optimum operating condition of the two-stage gun tunnel is obtained by matching the gun tunnel diaphragm rupture with the position of the heavy piston in the compressor It is concluded that the stagnation pressure and temperature become higher by 60% and 10%, respectively, than those of a conventional gun tunnel (Author)

**A79-13988** * # **Lifting-line theory of oblique wings** H K Cheng (Southern California, University, Los Angeles, Calif ) *AIAA Journal*, vol 16, Nov 1978, p 1211-1213 9 refs Contract No N00014-75 C-0520, Grant No NCA2-OR730-601

The study extends Prandtl's lifting-line theory to planar wings involving swept and curved centerlines Attention is focused on distinct features of such a theory, with special emphasis on an oblique wing in a steady incompressible potential flow The analysis presented is compared with exact solutions derived from an inverse method and with results from a panel method S D

**A79 13989** * # **Comparative study of the convergence rates of two numerical techniques** A Kumar (Old Dominion University, Norfolk, Va ) and R A Graves, Jr (NASA, Langley Research Center, Space System Div , Hampton, Va ) *AIAA Journal*, vol 16, Nov 1978, p 1214-1216 7 refs

The paper examines the applicability of the three-step Stetter (1968) method to the problem of hypersonic viscous flow over a blunt axisymmetric body used for planetary entry probes at zero angle of attack The flow-field results using the two-step finite difference MacCormack (1969) method are reported by Kumar and Graves (1977) Only the computational efficiency of Stetter's method is compared with that of MacCormack's in terms of the iterative time steps and computing time required for the steady-state solution Advantages of Stetter's method over MacCormack's are established S D

**A79-13991** **Aerodynamic field induced by a jet penetrating a cross flow at subsonic velocities (Champ aérodynamique induit par un jet pénétrant dans un écoulement transversal, en régime subsonique)** E Le Grives (ONERA, Châtillon-sous-Bagneux, Hauts-de Seine, France) *Journal de Mécanique*, vol 17, no 1, 1978, p 23-52 14 refs In French (ONERA TP No 1978-81)

A simplified model, based on a scheme used earlier to analyze penetration of jet into a subsonic flow, is adopted in order to represent the regular turbulent structure associated with jet penetration This approach leads to an explicit formulation of the laws of intensity and spacing of counterrotating vortices, and accounts for experimental results on the induced velocity fields and wall pressure distributions observed in the vicinity of an injection orifice P T H

**A79-14061** # **New technologies for transport aircraft - Expectations and hopes of the air transportation industry (Neue Technologien bei Verkehrsflugzeugen - Erwartungen und Hoffnungen des Luftverkehrs)** E Simon (Deutsche Lufthansa AG, Hamburg, West Germany) *Deutsche Gesellschaft fur Luft und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-099* 12 p In German

The paper considers the impact of advanced aircraft technologies on the direct operating costs of the air transportation industry It is expected that the development of such technologies as advanced composites, advanced aerodynamic controls, digital control technology, and improved engines can lead to substantial economic benefits for the industry B J

**A79-14069** # **Study of the integration of active control elements in the high lift system of a transport aircraft into maneuver control, gust-load control, and direct control of lift (Untersuchungen zur Integration aktiver Steuerelemente in das Hochauftriebssystem eines Transporterflugels zur Manover-, Boenlast- und direkten Auftriebssteuerung)** H Anders (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-111* 48 p In German

The paper describes the basic design philosophy of a high lift system which attempts to integrate three types of lift control maneuver control, gust-load control, and direct control The Boeing YC-14 prototype is taken as the base configuration Wing design with high-lift control surfaces implemented on the basis of this integrated technology is considered Particular attention is given to wing-flap modifications and to the aerodynamic characteristics of flap systems A theoretical model for investigating the dynamic response of this configuration is presented The particular application of the control techniques to terrain following aircraft is discussed B J

**A79-14070** **Parametric investigation of vertical canards at large incidence angles (Parametrische Untersuchungen zur Anwendbarkeit von Kinnrudern bei grosseren Anstellwinkeln)** W Sonnleitner (Messerschmitt Bolkow-Blohm GmbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-112* 29 p 7 refs In German

The paper presents an analysis of the flight stability and control of vertical canard configurations Variations of lateral and longi-

tudinal stability with incidence angle are investigated, and attention is given to the effectiveness of single and double control surfaces in different positions Lift and directional stability are correlated, and variations of longitudinal stability with control deflection are examined Tail modifications for ensuring stability are discussed B J

**A79-14071 Aerodynamic characteristics of combat aircraft at large angles of attack (Aerodynamische Eigenschaften von Kampfflugzeugen bei hohen Anstellwinkeln)** W Kraus and H John (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-113* 49 p 5 refs In German

The wind tunnel experiments discussed were carried out to study the limiting angle of attacks for delta and canard poststall configurations The control limits for combat maneuvers are established for a number of models The stability and controllability of the principal model versions in pitch, roll, and yaw at high angles of attack are identified V P

**A79-14072 # The high-lift characteristics in the case of the V-wing concept (Das Hochauftriebsverhalten beim Rautenflugelkonzept)** H Zimmer (Dornier GmbH, Friedrichshafen, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-114* 43 p 14 refs In German Bundesministerium der Verteidigung Contract No T-RF 41-80412-61433

The novel V wing concept considered by Letcher (1972) has been studied by a German aerospace company in theoretical and experimental investigations since 1975 Experimental results have been obtained for two models in two low-velocity and two high-velocity tunnels A number of parameters were varied in the tests The expected reduction of the induced drag and the wave drag and an increase in maximum lift were confirmed by the experimental data The first structural calculations regarding a hypothetical large-scale design were also performed It appears on the basis of the obtained stresses and deformations that the considered wing concept is also feasible with respect to the material strength requirements involved G R

**A79-14073 # Determination of the dynamic derivatives of lengthwise and side movement with the mobile oscillating derivative balance and systematic studies of the influence of several parameters on the results (Ermittlung von dynamischen Derivativen der Langs- und Seitenbewegung mit der Mobilen Oszillierenden Derivativwaage und systematische Untersuchungen zum Einfluss einiger Parameter auf die Ergebnisse)** O Determann (Darmstadt, Technische Hochschule, Darmstadt, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-115* 13 p 10 refs In German

Procedures for interpreting data obtained by the mobile oscillating derivative balance, a measuring system for a 3-m low-velocity wind tunnel, are considered The balance utilizes the principle of forced harmonic vibrations, and the derivative is determined from linear motion equations obtained from studies of models in wind and without wind The use of Fourier analysis and a regression analysis to process data is examined, and the determination of the minimum amount of data required for reproducible results is explained The effects of variation in movement parameters is considered with reference to example cases M L

**A79-14077 Engine requirements for the next generation of fighter aircraft (Anforderungen an die Antriebsanlage der nachsten Kampfflugzeug-Generation)** W Biehl (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78 124* 38 p 7 refs In German

Fighter aircraft requirements are discussed with reference to poststall capability Topics examined include inflow mechanism, power consumption, flight attitude, oil system, steering, jet shape, tail shape, and engine regulation Main developmental goals for achieving poststall capability are indicated M L

**A79-14078 # New technologies as basis for development of propulsion systems for future fighter aircraft (Neue Technologien als Basis fur die Entwicklung von Triebwerken fur zukunftige Kampfflugzeuge)** L Schweikl (Motoren und Turbinen-Union Munchen GmbH, Munich, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-125* 32 p 6 refs In German

Examples of high pressure compressors, high-pressure turbines, and thrust vector controls are discussed in order to show how requirements on the propulsion system of new fighter aircraft can be satisfied through the use of new technologies It is shown how progress in aerodynamics and power increases can be obtained through use of new materials and processing techniques and by means of new structural solutions New concepts in cooling and deflectable nozzles are discussed P T H

**A79-14079 # Propulsion concepts for future fighter aircraft (Antriebskonzeptionen fur zukunftige Kampfflugzeuge)** H Grieb (Motoren- und Turbinen-Union Munchen GmbH, Munich, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-126* 30 p In German

The requirements which the propulsion systems of future fighter aircraft will have to satisfy are briefly examined and a description is presented of the aero/thermodynamic possibilities available for increasing aircraft performance, taking into account the existing technological limits The available scope for improvements which can be obtained by introducing new technology is illustrated with the aid of examples Particular attention is given to approaches for simplifying propulsion units A comparison is conducted of the effectiveness of various propulsion system concepts The reported investigation shows that further developments in the area of fighter aircraft engines within the next decade will hardly involve the introduction of basically new propulsion system concepts It is expected that developments related to a use of improved components in two-cycle engines with afterburner will provide very significant advances G R

**A79-14080 Effect of forward speed on noise emission and thrust of small aircraft propellers (Einfluss der Vorwartsgeschwindigkeit auf Larmemission und Schub von Kleinflugzeug Propellern)** P Bartels (Dornier GmbH, Friedrichshafen, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78 127* 48 p 31 refs In German

Experimental and numerical studies of the effect of forward speed on noise and performance are reported for rigid and variable-pitch propellers in the range from 75 to approximately 150 kW (100 to 200 hp) range Thrust-performance relationships and noise spread characteristics for a conventional propeller are described, and the narrow-band spectra which are presented show the higher harmonics in the propeller noise Salient noise and performance characteristics are analyzed M L

**A79-14085 # Impact of new navigation methods on flight guidance in the terminal maneuvering area (Auswirkungen neuer Navigationsverfahren auf die Flugfuhrung im Flughafen-Nahbereich)** G Schanzer (Braunschweig, Technische Universitat, Braunschweig, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-135* 27 p 37 refs In German

It is noted that the new navigation methods involving microwave landing systems and satellite navigation systems will lead to improved

navigation accuracy and curved flight path profiles This paper reviews various aspects of the implementation of advanced flight control techniques and evaluates their potential impacts in such areas as flight safety, flight guidance, human factors engineering, and data processing Particular attention is given to the development of digital flight control systems, the realization of curved flight profiles, and problems associated with the pilot/control system interface B J

**A79-14086** # **MILECS - An integrated navigation and air traffic control system for the future needs of international aviation (MILECS - Ein integriertes Navigations- und Flugsicherungssystem fur den zukunftigen Bedarf der internationalen Luftfahrt)** A Becker (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugfuhrung, Braunschweig, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-136* 20 p 7 refs In German

The paper demonstrates the suitability of the DME-based Landing System (DLS) for the basis of an integrated navigation and flight control system An essential feature of an integrated system is that all functions are carried out on a single frequency channel The functions of DLS can be easily extended to include hemispheric azimuth covering and elevation covering, ground-derived DME, ground-derived difference DME, ground tracking, and selective ground-air/air-ground data links The proposed Microwave Integrated Landing/Enroute Navigation and Air Traffic Control system (MILECS) makes use of the following subsystems DLS, DME-based enroute navigation system, DME-based roll and guidance system, and DME-based air traffic control system Signal flows and structure for these systems are described P T H

**A79-14087** # **DAS for TMA navigation (DAS zur TMA-Navigation)** K D Eckert (Standard Elektrik Lorenz AG, Stuttgart, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-137* 17 p In German

The international competition involving the selection of a microwave landing system is briefly reviewed with particular attention given to DLS (DME Landing System) and TRSB (Time Reference Scanning Beam system) The bulk of the paper, however, is concerned with the development of DAS (DME Azimuth System) for navigation in the terminal maneuvering area (TMA) The structural organization plan for the DAS program is presented B J

**A79-14088 Design of the TKF system in relation to experience with the CCV-F104 program and functional redundancy (Auslegung der Systeme des TKF unter Berucksichtigung der Erkenntnisse aus dem CCV-F104-Programm und der Funktionsredundanz)** G Kissel (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-139* 37 p In German

The paper reviews various problems associated with the development of digital flight control systems for tactical fighter aircraft (TKF - Taktische Kampflugzeuge) with reference to experience gained with the CCV-F104 program Particular attention is given to problems of functional redundancy, error detection concepts, parallel redundancy, and software testing A systems approach is taken to the discussion of such problems and features as skewing, the data buses, the interface units, the display subsystem, and the allocation of display and control functions B J

**A79-14089** # **Automatic failure detection systems in commercial aircraft (Automatische Fehlererkennungssysteme in Verkehrsflugzeugen)** H Hauser (Messerschmitt Bolkow-Blohm GmbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft- und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-140* 28 p In German

The paper describes the master warning system and the built-in test equipment which function as an automatic system for detecting aircraft system malfunction and warning crews Characteristics of the digital master warning system and the automatic fault identification system (AFIS) used in Airbus A310 are examined AFIS uses a microcomputer to provide a text printout for the failure report The supplemental relationship between master warning system and AFIS is considered, failure indications and automatic failure detection are discussed, and the problem of limitation in system design modification is noted M L

**A79-14095** # **Synthetic image generation for visual simulation in training simulators using the Tornado visual simulator as an example (Synthetische Bilderzeugung fur die Sichtsimulation in Trainingssimulatoren dargestellt am Beispiel des Tornado-Sichtsimulators)** W Metze (Messerschmitt Bolkow Blohm GmbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft und Raumfahrt and Hermann-Oberth-Gesellschaft, Deutscher Luft und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, DGLR Paper 78-150* 10 p In German

The paper reviews the principles of synthetic image generation and presents a general procedure for this process Consideration is then given to the application of synthetic image generation using the CGI (Computer Generated Imagery) system in the training simulator of the MRCA ('Tornado') aircraft The technical characteristics of the MRCA visual simulator are described, and some system variants of the CGI technique are discussed B J

**A79-14105** # **Lightning protection from aircraft (Probleme des Blitzschutzes bei Luftfahrzeugen)** D Jaeger (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt and Hermann-Oberth Gesellschaft, Deutscher Luft und Raumfahrtkongress, Darmstadt, West Germany, Sept 19-23, 1978, Paper* 35 p 8 refs In German

Protection of metal aircraft, partly plastic aircraft, and helicopters from lightning is discussed with attention to the nature of lightning and its interaction with an aircraft The relation between lightning parameters and lightning effects is considered It is suggested that satisfactory procedures have been developed for protecting metal aircraft from lightning, but new aircraft, made partly from plastic and containing complicated avionics, will require the development of new systems for protection against lightning M L

**A79-14136 * Technology for aircraft energy efficiency** J M Klineberg (NASA, Washington, D C) In International Air Transportation Conference, Washington, D C, April 4 6, 1977, Proceedings New York, American Society of Civil Engineers, 1977, p 127-171

Six technology programs for reducing fuel use in U S commercial aviation are discussed The six NASA programs are divided into three groups Propulsion - engine component improvement, energy efficient engine, advanced turboprops, Aerodynamics - energy efficient transport, laminar flow control, and Structures - composite primary structures Schedules, phases, and applications of these programs are considered, and it is suggested that program results will be applied to current transport derivatives in the early 1980s and to all-new aircraft of the late 1980s and early 1990s M L

**A79-14137 Very large aircraft - Technology and operational implications** R L Foss (Lockheed-California Co, Burbank, Calif) In International Air Transportation Conference, Washington, D C, April 4-6, 1977, Proceedings New York, American Society of Civil Engineers, 1977, p 172 196

This paper discusses future growth trends of commercial aircraft, starting with historical patterns that indicate the changes in airplane physical dimensions and weight that have occurred over the last several decades Reasons for the observed growth are reviewed Size of today's large aircraft is summarized for reference Projections of commercial needs for the future are outlined Their potential

impact on future aircraft growth patterns is shown in terms of added range, payload, and change in cruise speed The consequences and benefits of switching to alternate fuels, returning to turboprop power plants, adopting airships, or revitalizing sea planes is examined Benefits of advanced technology considering new structural materials, laminar flow control, and advanced flight control systems is discussed Typical aircraft of the future are illustrated From this collection, a likely list of candidates that may be operational in 1995 is offered, together with the rationale for their selection (Author)

**A79-14138 * Alternate aircraft fuels prospects and operational implications** R D Witcofski (NASA, Langley Research Center, Hampton, Va ) In International Air Transportation Conference, Washington, D C , April 4 6, 1977, Proceedings New York, American Society of Civil Engineers, 1977, p 197-241 14 refs

The paper discusses NASA studies of the potentials of coal-derived aviation fuels, specifically synthetic aviation kerosene, liquid methane, and liquid hydrogen Topics include areas of fuel production, air terminal requirements for aircraft fueling (for liquid hydrogen only), and the performance characteristics of aircraft designed to utilize alternate fuels Energy requirements associated with the production of each of the three selected fuels are determined, and fuel prices are estimated Subsonic commercial air transports using liquid hydrogen fuel have been analyzed, and their performance and the performance of aircraft which use commercial aviation kerosene are compared Environmental and safety issues are considered M L

**A79-14139 Meeting airport ground access demands for the 1980's at Los Angeles International Airport** S Yee (Los Angeles, Dept of Airports, Dept of Aviation, Los Angeles, Calif ) In International Air Transportation Conference, Washington, D C , April 4-6, 1977, Proceedings New York, American Society of Civil Engineers, 1977, p 245-255

Major roads used for access to and circulation within the Los Angeles International Airport are described, and procedures for improving traffic flow and accessibility are examined Recent improvements include the addition of a traffic lane, the reversal of traffic flow on another street, the creation of a metered parking lot, and the use of illuminated tram stop signs (to identify stops for different tram services) Future improvements will involve major and minor road construction programs, dispersed parking lots, shuttle buses, and public transportation systems M L

**A79 14140 An overview of airfield pavement design** C L Monismith (California, University, Berkeley, Calif ) In International Air Transportation Conference, Washington, D C , April 4-6, 1977, Proceedings New York, American Society of Civil Engineers, 1977, p 256-324 75 refs

Physical data relevant to airport pavement construction, maintenance, and rehabilitation are presented, and the management of airport design is discussed Five categories of information required for design and rehabilitation are examined, the categories are traffic (load), environment, construction influences, available materials and layer thicknesses, and maintenance and rehabilitation consideration Physical characteristics of pavement materials are reported, pavement models are described, and forms of pavement distress are analyzed M L

**A79-14143 New aircraft technology and its impact on the airport - An airline viewpoint** R J Linn (American Airlines, Inc , New York, N Y ) In International Air Transportation Conference, Washington, D C , April 4-6, 1977, Proceedings New York, American Society of Civil Engineers, 1977, p 363-376

The economic effect of the FAR Part 36 noise limits on a major airline is examined with respect to the capital required to replace or modify aircraft which do not meet noise requirements The traditional aircraft replacement strategy is described and contrasted with the phased compliance schedule of FAR Part 36 It is recommended that aircraft incorporating high-bypass-ratio engines be introduced and that the S A M retrofit not be used Constraints imposed by airport characteristics on the design of new aircraft are considered M L

**A79-14183 Principle of operation of Navstar and system characteristics** R J Milliken and C J Zoller (Rockwell International Corp , Space Div , Downey, Calif ) *Navigation,* vol 25, Summer 1978, p 95-106

The paper describes the operation of the Navstar/Global Positioning System (GPS) Users will obtain three dimensional position and velocity information by measuring the transit time of RF signals from four satellites from among the 24 in the total system The signals are modulated with two codes P, which provides for precision time measurement, and C/A, which provides for easy lock-on to the desired signal The signal structure is presented, and an evaluation of system accuracy is given The GPS navigation solution is worked out P T H

**A79-14189 GPS receiver operation** B G Glazer (Magnavox Government and Industrial Electronics Co , Advanced Products Div , Torrance, Calif ) *Navigation,* vol 25, Summer 1978, p 173 178

The paper describes some of the equipment needed by the users of the Global Positioning System (GPS) and describes in general the measurements, position computation, and navigation computation The Z-set, an example of a near minimal GPS user receiver for noncombat military aircraft, is presented The process of determining the four satellites to be used, locking in on their signals measuring arrival times, getting the satellite position from its ephemeris, calculating position, and estimating accuracy is briefly described P T H

**A79-14190 Texas Instruments Phase I GPS user equipment** M J Borel, J N Damoulakis, D R Delzer, T D Fuchser, J H Hinderer, C R Johnson, and D J Pinkos (Texas Instruments, Inc , Dallas, Tex ) *Navigation,* vol 25, Summer 1978, p 179 194

To achieve a balance between utility and affordability, an approach to the design of Global Positioning System (GPS) user equipment based on common modules was taken The receiver has one to five channels Each channel contains two or three narrowband modules and one wideband, output, code, and frequency synthesizer module The navigation filter configuration optimizes the processing of pseudorange and pseudorange-rate measurements A detailed description of the filter is given and some simulation results are discussed P T H

**A79-14191 Performance enhancements of GPS user equipment** N B Hemesath (Rockwell International Corp , Collins Radio Group, Cedar Rapids, Iowa) *Navigation,* vol 25, Summer 1978, p 195 200

Techniques for improving the performance of GPS user equipment are discussed Attention is given to tracking errors under dynamics, beam steering, inertial aiding, and special processing techniques such as jammer estimation P T H

**A79-14192 Test and evaluation procedures for the GPS user equipment** S K Gupta (Rockwell International Corp , Collins Radio Group, Cedar Rapids, Iowa) *Navigation,* vol 25, Summer 1978, p 211 216 6 refs

Laboratory testing of GPS user equipment is described Design considerations for a satellite vehicle simulator system are discussed Simple models of ionospheric delay and tropospheric delay are used Overall development and testing of a system involves off line simulation and test, closed-loop simulation and test, and full up integration and test P T H

**A79-14193 GPS Phase I user equipment field tests** R Denaro (USAF, Space and Missile Systems Organization, Los Angeles, Calif ), V G Harvester, and R L Harrington (General Dynamics Corp , Electronics Div , San Diego, Calif ) *Navigation,* vol 25, Summer 1978, p 217-223

The program for field testing the GPS Phase I user equipment involves performance evaluation consisting of tests in a wide variety of environments and dynamics A helicopter, a transport aircraft, a truck, a long range patrol aircraft, and a fighter/bomber have been used as host vehicles during the tests performed on the Inverted Range Some navigation sequences are shown Tests have shown improvements in unguided bomb placement with the aid of GPS P T H

**A79-14194 Integration of GPS with inertial navigation systems** D B Cox, Jr (Charles Stark Draper Laboratory, Inc , Cambridge, Mass ) *Navigation,* vol 25, Summer 1978, p 236-245 51 refs

GPS and inertial navigation system have complementary features which can be exploited in an integrated system to create synergistic improvements in navigation performance The improvements are most pronounced when the GPS signal-to-noise ratios are low and the vehicle is undergoing high-dynamic maneuvers Ways in which varying degrees of integration might logically evolve from stand alone GPS and inertial systems are examined The simplest way to integrate the two is to provide a channel for delivering the position and velocity data from the GPS navigation solution to the INS navigation processor Better results can be obtained by supplying, with proper GPS INS time tags, raw GPS data and data from the INS mechanization algorithms, together with auxiliary sensor data, to an integrated GPS inertial navigation filter Use of an aided signal in a tracking loop is discussed P T H

**A79-14200 Optimum two dimensional wings in supersonic flows** H N V Dutt and A K Sreekanth (Indian Institute of Technology, Madras, India) *Journal of the Astronautical Sciences,* vol 26, July-Sept 1978, p 279-287

The problem of maximizing the lift-to-drag ratio of a slender two-dimensional airfoil in moderate supersonic flows is considered, and a general theory which includes constraints on all the geometrical characteristics of the airfoil is developed Results are presented for the case in which the chord is a prescribed quantity Linear and nonlinear cases are contrasted with respect to the point of maximum thickness and the possibility of a camber M L

**A79-14209 On mechanics of gyroscopes in gimbal suspension** A Iu Ishlinskii (Akademiia Nauk SSSR, Institut Problem Mekhaniki, Moscow, USSR) In Dynamics of multibody systems, Proceedings of the Symposium, Munich, West Germany, August 29-September 3, 1977 Berlin, Springer Verlag, 1978, p 87-96 16 refs

The paper surveys research on the mechanics of gyroscopes in gimbal suspensions from 1939 to 1976 Particular attention is given to the work of Nikolai (1939) on the motion of a balanced gyroscope on a fixed support under the assumption of negligible friction in the gimbal suspension axis, and to the work of Magnus (1955) on the systematic component of the angular velocity of the external gyroscope ring during nutation on a fixed support Later work is also reviewed, with emphasis on Ishlinskii's study (1952) of the behavior of a gyroscope on a moving support B J

**A79-14212 Dynamics of nonideal gyroscopic systems** D M Klimov (Akademiia Nauk SSSR, Institut Problem Mekhaniki, Moscow, USSR) In Dynamics of multibody systems, Proceedings of the Symposium, Munich, West Germany, August 29-September 3, 1977 Berlin, Springer Verlag, 1978, p 144-157 8 refs

The paper reviews recent research carried out at the Institute for Problems in Mechanics of the USSR Academy of Sciences in the field of nonideal gyroscopic systems Two problems regarding the motion of a gyroscope in gimbal suspension with nonideal ball bearings are considered (1) gyroscope dynamics with nonideal ball bearings of the rotor, and (2) gyroscope motion with nonideal ball bearings on the gimbal axes B J

**A79-14232 Band spread effect of a Doppler miss distance measurement system** A S Hu (New Mexico State University, Las Cruces, N Mex ) In International Telemetering Conference, Los Angeles, Calif , October 18 20, 1977, Proceedings Pittsburgh, Pa , Instrument Society of America, 1977, p 87 92 Grant No DAAG39 73-C 0011

A computer simulation method and a hardware-in-the-loop simulation method are used to study the band spread effect at short miss distances for single path Doppler missile scoring systems Computer simulation results indicated that the receiver bandwidth requirement is not critical because the Doppler frequency spectrum is dominated by receiver signal strength fluctuations System errors were larger for computer simulation results than for hardware simulation results This was due to the high gain receiver limiting property B J

**A79-14233 ACMR/I system** J J Parker (Cubic Corp , Defense Systems Div , San Diego, Calif ) In International Telemetering Conference, Los Angeles, Calif , October 18 20, 1977, Proceedings Pittsburgh, Pa , Instrument Society of America, 1977, p 95-103

The Air Combat Maneuvering Range/Instrumentation (ACMR/I) system is designed for the training and analysis of fighter pilots in high-performance missile-equipped aircraft It provides real-time attitude and position data on eight high dynamic fighter aircraft and position data on 12 additional cooperative targets Digital data is transmitted to and from the target by FSK of the ranging carrier A multiprocessor ground computer using Kalman filter techniques provides a total state vector for each participant at a rate of 10 per second The Display and Debriefing Subsystem provides real time computer-drawn pseudo-three-dimensional display of the aircraft, total replay capability, and control of the entire system from the operator's console B J

**A79-14247 JTIDS modular design to use SAW devices** C L Grasse (Teledyne MEC, Palo Alto, Calif ) In International Telemetering Conference, Los Angeles, Calif , October 18 20, 1977, Proceedings Pittsburgh, Pa , Instrument Society of America, 1977, p 325 335 5 refs

The Joint Tactical Information Distribution System (JTIDS) concept is designed to integrate the military's needs for communication, navigation and identification equipments into a cost effective avionic suite A key element to be used in achieving these goals is the surface acoustic wave (SAW) bandpass filter In order to satisfy the JTIDS requirements of today, as well as the Tactical Information Exchange Systems (TIES) of the future, it is necessary to utilize state of the art SAW resonator/filter designs in conjunction with more conventional SAW bandpass filter technology Attention is given to the JTIDS architecture, the SAW modular filter bank, the realization of the JTIDS ultranarrow band filters with the aid of a three pole SAW resonator filter, a 350 kHz withdrawal weighted transducer which satisfies JTIDS TACAN requirements, and a 7 MHz wideband communications channel filter G R

**A79-14291 A low cost blade design for a Darrieus-type vertical-axis wind turbine** D K Ai (Alcoa Research Laboratories, Pittsburgh, Pa ) *Wind Technology Journal,* vol 2, Spring-Summer 1978, p 18-23 13 refs

A brief description of the Darrieus type vertical-axis wind turbine (VAWT) is given, followed by a short history of its development Blade characteristics for the Sandia 5 m and 17 m research turbines are also shown With the mass-balance condition removed, a low cost blade based on a single piece of aluminum extrusion became feasible A set of 6 in chord blades of all airfoil section is used for Sandia's 5 m research wind turbine This blade is now commercially available Other VAWTs using this blade include the 5 m Dynergy machine and the Clarkson College/Alcoa/Agway/Niagara Mohawk machine Blades of larger chords of a similar design are in the planning It is expected that an 11 in chord blade will be

used for the DOE 8 kW machine to be installed at Rocky Flats, Colorado, and a 24 in chord blade for the DOE's low cost 17 m machines It is believed that within the size limitation of the existing extrusion presses, the all-aluminum single piece extrusion blade represents the most cost-effective blade for the Darrieus-type VAWT (Author)

**A79-14322 The total energy cost of freight transport** D B Reister (Oak Ridge Associated Universities, Inc, Oak Ridge, Tenn ) *Energy* (UK), vol 3, Aug 1978, p 493-498 5 refs

The average total energy required directly and indirectly to ship one ton of freight one mile by rail is estimated It is found that the average energy cost was about 1500 Btu per ton-mile in 1971, while the cost for a unit train was about 1000 Btu per ton-mile The total energy costs of freight transport by domestic water, local and intercity trucks, and air are also estimated B J

**A79-14401 SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings** Canoga Park, Calif, SAFE Association, 1977 308 p $15

The human factor in safety is considered along with USAF life support equipment costs, problems in contracting for system safety, the development of an automatic nerve agent alarm for chemical defense, regenerative life support systems for nuclear shelters, a pyrotechnic air generator, heat transfer principles in personal protection applications, and design considerations for inflatable head/neck restraint systems Attention is given to the design of aircraft emergency devices for emergency use, an objective look at disaster exercises, an inflatable restraint system, a microwave radiometric attitude reference system for a rocket-powered pilot escape seat, a relative motion analysis of horizontal collision avoidance, the effectiveness of pilot warning instruments, a performance evaluation of the experimental beacon collision avoidance system, the prevention of helicopter mid-air collisions with the proximity warning device, the development of anti-G valves for high performance aircraft, and an economical approach to an accident information retrieval system G R

**A79-14403 Can government specified reliability and maintainability requirements for complex aircrew escape systems be met.** R M Sineath (Stencel Aero Engineering Corp, Asheville, N C ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 8-12

The report summarizes a contractor's experience in complying with Naval Air Systems Command (NAVAIR) Reliability and Maintainability requirements for Aircrew Escape Systems It provides background and insight into the methodology needed to ensure reliable and easy-to maintain escape systems Key elements of Reliability (R) and Maintainability (m) Programs are discussed, and how those elements fit with NAVAIR requirements and were effectively implemented This R/m Program resulted in an aircrew escape system which has been successful in all ejections attempted, and has exceeded all R/m requirements in over two years of in-service use The author recommends these government specified R/m requirements be applied to all safety equipment rather than just Aircrew Escape Systems (Author)

**A79-14410 A relative motion analysis of horizontal collision avoidance** J W Andrews (MIT, Lexington, Mass ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 58-61 U S Department of Transportation Contract No FA77WA-1432, Contract No F19628-78-C 0002

In the design of automated collision avoidance systems, it is difficult to devise resolution strategies which are valid for the wide range of aircraft speeds and collision geometries which may be encountered in normal flight This is especially true with regard to collision avoidance in the horizontal plane This paper discusses a technique for the analysis of horizontal relative motion between aircraft and applies the results to the collision avoidance problem By expressing the projected miss distance as a fraction of range, a set of miss distance contours may be constructed which allow determination of the effect of heading changes upon the ultimate closest approach Inspection of these contours allows identification of geometries in which specific resolution strategies are appropriate (Author)

**A79-14411 The effectiveness of pilot warning instruments - An engineering model based upon flight test data** J W Andrews (MIT, Lexington, Mass ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 62-67 8 refs U S Department of Transportation Contract No FA77WA-1432, Contract No F19628-78-C-0002

'See-and-avoid' is the primary means of assuring safe separation between aircraft for the large fleet of general aviation aircraft which operate under visual flight rules (VFR) For many reasons, however, see-and-avoid as currently practiced offers only limited reliability as a means of separation assurance Recently serious efforts have been directed toward the development of a pilot warning (or proximity warning) instrument (PWI) which would alert the pilot to the presence of a collision hazard and assist him in visually locating the aircraft in question In particular, PWI is an integral part of the Automatic Traffic Advisory and Resolution Service (ATARS) which the FAA is developing for possible implementation in the next decade ATARS is an automated ground-based collision avoidance system which utilizes the radar position reports of the Discrete Address Beacon System in order to detect potential collision hazards A description is presented of an investigation involving the study of the effectiveness of the ATARS system G R

**A79-14412 Performance evaluation of the experimental BCAS /Beacon Collision Avoidance System/** J Vilcans, J Raudseps, and R W Wisleder (U S Department of Transportation, Transportation Systems Center, Cambridge, Mass ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 68-72 FAA-supported research

The FAA to date has not endorsed any collision avoidance system (CAS) for airline use The reasons for this include the incompatibility of the CAS systems tested with the air traffic control (ATC) equipment and procedures, as well as their measured high false alarm rates An alternative system concept, the BCAS, based explicitly on the reception of the Air Traffic Control Radar Beacon System (ATCRBS) signals in space, has been evaluated and shows significant promise of being suitable for becoming an implemented system Analyses and flight test data show that BCAS is a technically feasible concept Accurate range and bearing can be computed for the passive mode There is no perceptible interference effect upon ATCRBS surveillance G R

**A79-14413 Preventing helicopter mid-air collisions with the proximity warning device** O Schoenberger (U S Army, Avionics Research and Development Activity, Fort Monmouth, N J ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 73-76

An analysis has been conducted of 105 mid-air collision accidents involving commercial and general aviation aircraft With the majority of collisions occurring at convergence angles of 0 to 10 degrees, the fact that tail-on collision is very likely in an aircraft environment of large speed differentials is validated In the late 1960's the mid-air collision problem at U S Army Helicopter pilot training bases reached proportions, where the need for an airborne device to reduce the mid-air collision rate became very apparent In response to this requirement, the Proximity Warning Device (PWD) was developed The PWD provides a visual and oral warning to the helicopter pilot whenever another helicopter equipped with the same device is within a pilot selected range of 1000, 3000, or 5000 feet and within a relative altitude of plus or minus 300 feet This provides

a 'protective volume' around the helicopter In an investigation it was found that the PWD was capable of handling extremely high traffic densities without saturation or deterioration of its performance G R

**A79-14414 Development of anti-G valves for high performance aircraft** R M Shaffstall and R R Burton (USAF, School of Aerospace Medicine, Brooks AFB, Tex ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev , December 5-8, 1977, Proceedings Canoga Park, Calif , SAFE Association, 1977, p 77-79 5 refs

The anti-G suit and inflation valve currently in use in the F-15 remained basically unchanged since the 1940's The possibility that improvements would be required was suggested by test pilots in April 1976 Thus, studies were undertaken at the USAF School of Aerospace Medicine to develop an anti G valve which will meet the requirements of today's high performance aircraft In 1975, Burton et al evaluated the effect of early suit pressurization and various pressurization levels in relaxed, rapid onset acceleration profiles The results of this study indicated that some early increase in suit pressurization over the standard inflation rate could improve relaxed G tolerances The development of an operational anti-G valve for high performance fighter aircraft is discussed G R

**A79-14417 Explosive removal of egress panels for emergency escape from helicopters underwater** J L Hinds (U S Navy, Ordnance Systems Command, Indian Head, Md ) and D B Moore (Explosive Technology, Inc , Fairfield, Calif ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev , December 5-8, 1977, Proceedings Canoga Park, Calif , SAFE Association, 1977, p 116 119

In 1973, a study was conducted to determine the cause of a high number of passenger fatalities occurring in what appeared to be routine egress from helicopters after water ditchings Survivors of these accidents reported in-rushing water as the main problem in escaping from the aircraft Based on the findings of the study, it was recommended that large troop carrying helicopters need more escape routes A program was in this connection initiated to ascertain the feasibility of using explosive severance techniques in close proximity to human beings underwater The conducted investigations demonstrated conclusively that explosive charges may be used to obtain large egress hatches in submerged and flooded aircraft compartments with no significant damage to human occupants G R

**A79-14418 A systemized approach to helicopter safety** A S Hellman, G P Gillespie (U S Naval Material Command, Naval Air Development Center, Warminster, Pa ), and M Sloane (Sanders and Thomas, Inc , Pottstown, Pa ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev , December 5 8, 1977, Proceedings Canoga Park, Calif , SAFE Association, 1977, p 120-126 5 refs

The paper describes the systemized approach used by the U S Navy to develop a mission-specific functionally integrated system of clothing and equipment for each member of a military helicopter air crew Two systems are described in detail The first system involves inflatable survival systems to enhance chances of survival in a water ditching emergency, emphasis is placed on the investigative processes used to select the most feasible systems for aircraft incorporation The second system described involves an integrated helmet system suitable for the various missions performed by the mobile aircrewmen in helicopters M L

**A79-14419 An economical approach to an accident information retrieval system /AIRS/** L T Burrows (U S Army, Applied Technology Laboratory, Fort Eustis, Va ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev , December 5-8, 1977, Proceedings Canoga Park, Calif , SAFE Association, 1977, p 127 130

Aircraft accident prevention and design for crashworthiness would be enhanced by a better knowledge of the accident causes and crash impact forces Accordingly, the Army established a program for the definition of an economical Accident Information Retrieval System (AIRS) that would record flight and crash impact data Hamilton-Standard performed the design under contract The AIRS resulting from this program embodies advanced electronic technology and has an installed weight and cost of approximately 15 pounds and $10,000 This represents a significant step towards the realization of a compact low cost system that could have application to civil aircraft as well as military helicopters and fighters (Author)

**A79-14420 Paracone ejection seat** R T Kendall (U S Army, Washington, D C ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev , December 5-8, 1977, Proceedings Canoga Park, Calif , SAFE Association, 1977, p 131-135

The Paracone ejection seat system is described, and it is suggested that the system offers many advantages over present parachutes The Paracone inflatable structure consists of a 12-inch diameter tubular plenum gas distribution/flotation chamber that inflates in 1 to 3 sec to 3 psi plus or minus 1 psi This structure surrounds and attaches to the periphery of the seat structure in the aircraft One gas generator inflates the torus, and a second generator inflates the plenum/flotation chamber and the distribution ducts Advantages of the Paracone ejection seat with respect to high speed ejection, the terminal velocity impact, and the survival potential after impact are discussed, and the feasibility of constructing Paracone ejection seats is considered M L

**A79-14423 Aerodynamics and performance of a gliding parachute with landing brakes** H G Heinrich (Minnesota, University, Minneapolis, Minn ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev , December 5-8, 1977, Proceedings Canoga Park, Calif , SAFE Association, 1977, p 161-168

Aerodynamic characteristics of gliding parachutes are presented in form of coefficients Design features of a new gliding parachute are described which has a stagnation chamber for rigidizing the leading edge and aerodynamic brakes for glide angle variation A wind tunnel model and full-sized parachutes have reached glide angles between 30 and 35 deg and showed steady vertical descent with fully deployed brakes (Author)

**A79-14424 Parachute partial inversions** R B Calkins (USAF, Aerial Delivery and Parachute Branch, Wright-Patterson AFB, Ohio) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev , December 5-8, 1977, Proceedings Canoga Park, Calif , SAFE Association, 1977, p 176-179

Ever since the personnel parachute was first used, malfunctions and damage from partial inversions have been, and still are, common Damage caused by partial inversion includes friction burns, blown section and gores, broken suspension lines, and broken skirt bands Partial inversions occur when part of the skirt of one section passes under the skirt band of another section and opens inside out, or inverted The popular idea that 'Mae Wests' are caused by 'line overs' is a misunderstanding of what is actually a partial inversion Ways to reduce or eliminate partial inversion malfunctions have been investigated and a barrier below the skirt has been successfully used (Author)

**A79-14426 A system for survival** N F Pooler (USAF, Aeronautical Systems Div , Wright Patterson AFB, Ohio), F B Burkdoll, and N C Gardner (Explosive Technology, Inc , Fairfield, Calif ) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev , December 5-8, 1977, Proceedings Canoga Park, Calif , SAFE Association, 1977, p 215, 216

A set of passenger aircraft escape systems, employing explosive or pyrotechnic methods, has been designed The major components are (1) electromechanical mechanisms located in the crew or cockpit areas, (2) interior and exterior initiation handles located at emergency exits, (3) shielded mild detonating cords, and (4) flexible linear shaped cutting charges Filmed operations have shown that the system opens aircraft emergency exits in less than one thousandth of

a second, automatically deploys slides and/or liferafts, cannot be jammed shut, always jettisons doors outward, can be built into existing structures, and cannot ignite fuels or fuel vapors occurring in survivable crashes S C S

**A79 14427** **A new dimension in 'SAR'** R J Perchard In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 217 219

The poncho-like covering that protects the occupant of a one man life raft designed for use by astronauts is described The material used is a film and nylon laminate which offers radar reflection up to 100%, depending upon sea state and the height and distance of the search aircraft With regard to visual reflectivity, the covering is described as a film which sparkles in the sun like a million orange mirrors The laminate is light weight, water proof, rot proof, nonporous, and heat reflecting The evolution of raft design and the limited radar reflectivity of some rafts are considered M L

**A79-14430** **An air launched test vehicle for ejection seat parachutes** D R Dennis (Royal Aircraft Establishment, Farnborough, Hants, England) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 227-231

A bomb-like test vehicle has been designed at the Royal Aircraft Establishment, Farnborough, in collaboration with Martin-Baker Aircraft Co Ltd, for determining the performance and ultimate strength, over a range of altitudes, of escape parachutes used with Martin-Baker ejection seats The vehicle is carried in the bomb bay of a Canberra aircraft and released at speeds up to 400 kn Seat stabilising drogues are then deployed, in the same manner as on the ejection seat system, to extract the escape parachute under test By varying the aircraft release speed and altering the vehicle system time delays the test parachute can be deployed at any selected trajectory speed in the range 150-280 kn EAS Parachute break up speed is determined by increasing the deployment speed on successive drops until significant parachute damage occurs The test vehicle is described in detail, together with some typical parachute test data obtained on the GQ Aeroconical escape parachute (Author)

**A79-14431** **A parachute that goes up** R E Rychnovsky (Sandia Laboratories, Livermore, Calif) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 232-235 Contract No AT(29-1)-789

A two-stage lifting parachute system has been developed for very low-altitude subsonic and transonic deliveries The system reduces the impact energy of a payload to one tenth that of a single-stage system Tests have been conducted from Mach 0 45 to 1 25 with deliveries as low as 85 feet above ground level Computer simulations indicate that the system can lift a payload over 500 feet for high subsonic deployment velocities The lifting parachute may be used for recovering the crew and passengers and for removing the instrumentation and/or equipment in cases of emergency S C S

**A79 14439** **Clear air turbulence accidents** A I Brunstein (National Transportation Safety Board, Washington, D C) In SAFE Association, Annual Symposium, 15th, Las Vegas, Nev, December 5-8, 1977, Proceedings Canoga Park, Calif, SAFE Association, 1977, p 272-274

National Transportation Safety Board air carrier records for 1964-1975 show 68 accidents involving clear air turbulence (CAT) One hundred eighty-four persons were injured and there were thirty-six fatalities Most aircraft involved were jets and most accidents occurred between 31,000 and 35,000 ft in normal cruise CAT forecasting was not particularly accurate The airlines have suffered severe economic penalties, probably in excess of $23,000,000 annually It is concluded that more accurate and timely CAT forecasts are needed, CAT detection systems, airborne and ground-based are needed, and real time weather data are required on the ground and particularly in the cockpit (Author)

**A79-14475** # **Flight simulators (Aviatsionnye trenazhery)** V A Bodner, R A Zakirov, and I I Smirnova Moscow, Izdatel'stvo Mashinostroenie, 1978 190 p 31 refs In Russian

The book deals with the fundamentals of flight-simulator designing and with the mathematical modeling of aircraft systems The problem of determining dynamic similarity criteria for flight simulators is studied by analyzing the equations of aircraft motion Some psychophysiological properties of the human operator which must be taken into consideration in the formulation of informational similarity criteria are examined A method of synthesizing flight-simulator characteristics is outlined, along with mathematical models of an aircraft and its onboard systems The software of digital and analog flight simulators is reviewed V P

**A79-14517** # **Design of two-dimensional external compression supersonic inlets** M D N Rao (Hindustan Aeronautics, Ltd, Bangalore, India), T S Ramamurthy, and B Dattaguru (Indian Institute of Science, Bangalore, India) *Aeronautical Society of India, Journal*, vol 28, Nov 1976 (Sept 1978), p 391-398 7 refs

The analysis and design of two-dimensional external-compression inlets with two shock and three shock configurations are reported Consideration is given to variations in inlet geometry (ramp translation and/or rotation) for several engine parameters A computer program, designed to develop an optimal inlet configuration for two turbojet engines, is presented S C S

**A79-14550** # **Automatic stabilization of helicopters (Avtomaticheskaia stabilizatsiia vertoleta)** V A Kozhevnikov Moscow, Izdatel'stvo Mashinostroenie, 1977 152 p 35 refs In Russian

The mathematical model of the helicopter is examined, and the equations of motion are analyzed The principal topics covered include the dynamic properties of the helicopter rotor, methods of allowing for rotor dynamics in the determination of control forces and moments, autopilots for helicopter stabilization with respect to the center of mass and for stabilizing the center of mass itself, and general synthesis methods for helicopter control systems Some aspects of the numerical simulation of atmospheric turbulence are discussed V P

**A79-14613** **A miniature air sonar altimeter** C W Ross (Plessey Marine, Templecombe, Somerset, England) In Ultrasonics international 1977, Proceedings of the Conference, Brighton, England, June 28-30, 1977 Guildford, Surrey, England, IPC Science and Technology Press, Ltd, 1977, p 448 455 5 refs

An air sonar echo ranging device was developed in prototype form to demonstrate the effectiveness of a single-transducer system, requiring little adjustment for optimum performance The device is intended primarily as an altimeter for use on miniature remotely piloted aircraft for terrain following applications This paper describes the single-transducer system design and the associated electronics Particular attention is given to limitations of near range in the transducer system due to the inherent high Q of the transducer and reverberation in the back mass B J

**A79-14662** **Comparison of typical gyro-errors for strapdown applications** D K Joos (Bodenseewerk Geratetechnik GmbH, Uberlingen, West Germany) In Symposium on Gyroscope Technology, Stuttgart, West Germany, September 28, 29, 1977, Proceedings Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1978, p 2 0 2 23

Analysis of dynamic errors of strapdown gyrosystems is carried out First, an exact mathematical model of the behavior of a single degree of freedom floated gyro is developed and the resulting static and dynamic gyro errors are estimated Since the strapdown system will be sensitive to the rotational and translational vibrations of the vehicle, an anisoinertia term is added, which produces a torque about the output axis if simultaneous oscillations about the spin and

input axis are present On the basis of measured parameters of the vibrational environment of an actual launch vehicle, gyro drift rates due to dynamic errors are estimated Error compensation methods for a tuned gyro are discussed P T H

**A79-14663 Inertial measuring unit for strapdown application** W Ebert (Litton Technische Werke Freiburg im Breisgau, West Germany) In Symposium on Gyroscope Technology, Stuttgart, West Germany, September 28, 29, 1977, Proceedings Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1978, p 3 0-3 24

The basic configuration of an inertial grade strapdown navigation system - the LN 50 consists of the inertial measuring unit (IMU), the computer, and the control and display unit The inertial measuring unit consists of (1) the mechanical sensor block carrying the three degree of-freedom dry tuned gyros and three single axis dry pendulous accelerometers, and (2) the convection cooled housing containing the sensor block and the electronics consisting of sensor rebalancing electronics, built in test electronics, and power supply The rebalance circuit is based on the forced limit cycle method The structure of the IMU outputs and inputs is summarized, and some navigational test results are presented P T H

**A79-14668 Application of a north seeking heading and attitude reference for the autonomous navigation of helicopters** V Held and H Wilhelm (Elektronik System GmbH, Munich, West Germany) In Symposium on Gyroscope Technology, Stuttgart, West Germany, September 28, 29, 1977, Proceedings Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1978, p 10 0-10 31

Several concepts for self contained navigation systems for helicopters are available (1) systems with magnetically slaved heading and attitude reference set and Doppler radar, (2) inertial navigation system (INS), and (3) system with north-seeking heading and attitude reference (NHARS) and Doppler radar Simple error models were used to evaluate these three types of systems Factors most heavily influencing the errors of the systems were identified For an assumed straight flight at 120 n mi /hr, a self contained navigation system based on NHARS/Doppler gave errors with reference to the flight distance that were only half those of an inertial navigation system P T H

**A79-14671 Considerations on optimal self-alignment of gyrostabilized platforms** A Truckenbrodt and P C Muller (Munchen, Technische Universitat, Munich, West Germany) In Symposium on Gyroscope Technology, Stuttgart, West Germany, September 28, 29, 1977, Proceedings Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1978, p 15 0-15 17 7 refs

Optimal self alignment control systems of gyrostabilized inertial platforms are considered The control system has to fulfill the demands of a short alignment time and of a good alignment accuracy also in the presence of internal and external disturbances In general, conventional control techniques, such as leveling and gyrocompassing, cannot satisfy these demands simultaneously Therefore, methods of modern control theory, such as disturbance rejection control and optimal observer design, are applied to the design of self-alignment control systems to improve alignment time as well as alignment accuracy (Author)

**A79-14796 * # Correlation of combustor acoustic power levels inferred from internal fluctuating pressure measurements** U H von Glahn (NASA, Lewis Research Center, Cleveland, Ohio) *Acoustical Society of America, Meeting, 96th, Honolulu, Hawaii, Nov 26-Dec 1, 1978, Paper* 24 p 12 refs

Combustion chamber acoustic power levels inferred from internal fluctuating pressure measurements are correlated with operating conditions and chamber geometries over a wide range The variables include considerations of chamber design (can, annular, and reverse-flow annular) and size, number of fuel nozzles, burner staging and fuel split, airflow and heat release rates, and chamber inlet pressure and temperature levels The correlated data include those obtained with combustion component development rigs as well as engines (Author)

**A79-14834 Influence of liquid oscillations in fuel line on head of pump operating in regimes without reverse flow** V G Kinelev *(Aviatsionnaia Tekhnika,* vol 20, no 3, 1977, p 52 57 ) *Soviet Aeronautics,* vol 20, no 3, 1977, p 40-43 Translation

Consideration is given to the effect of fluid self-oscillations in a fuel line on the pressure-head and cavitation-flow characteristics of the pump These oscillations are conditioned by the formation of separated vortex regions in the screw pump As pressure drops in the pump entrance, vortex regions become visible due to the appearance of cavitation in the centers of the vortices that produce these regions Experimental data are examined for the case of a centrifugal screw-pump B J

**A79-14844 Representation of compressor characteristics in coordinates convenient for computer calculation of GTE parameters** V I Bakulev, K A Malinovskii, and V S Iakushev *(Aviatsionnaia Tekhnika,* vol 20, no 3, 1977, p 114-117 ) *Soviet Aeronautics,* vol 20, no 3, 1977, p 86-89 Translation

**A79-14845 Influence of some factors on GTE turbine blade vibrational energy dissipation** A I Bezhenov *(Aviatsionnaia Tekhnika,* vol 20, no 3, 1977, p 117-121 ) *Soviet Aeronautics,* vol 20, no 3, 1977, p 90-93 Translation

Experimental results are presented on the vibration damping characteristics of a turbine blade Particular emphasis is placed on three aspects of the damping problem (1) determination of the magnitude of structural damping as a function of the means of fastening the blades to the footing, (2) investigation of the effect of the transverse force of blades pressing against the footing on structural damping, and (3) study of the conditions of vibrational-energy dissipation into the foundation Graphs are presented describing the dependence of the logarithmic decrement of blade vibrations on the aforementioned factors B J

**A79-14847 Determination of ejector nozzle starting parameters** I N Denisov and V F Sivirkin *(Aviatsionnaia Tekhnika,* vol 20, no 3, 1977, p 125 129 ) *Soviet Aeronautics,* vol 20, no 3 1977, p. 98-101 5 refs Translation

A physical flow picture involving the transition from a separated to self-similar (nozzle start up) flow regime is used to develop a model for determining inlet pressure and secondary-contour pressure in a supersonic ejector nozzle at start-up The method is based on the assumption that at the beginning of start-up, the active-flow boundary layer streamline is tangent to the supersonic nozzle casing, this being the streamline at which total pressure is equal to ambient pressure Computational results are shown to be in good accord with experimental results B J

**A79-14848 Influence of stator vane canting on alternating stress level in turbine rotor blades** A A Kovalev, V A Strunkin, and I I Kurtseva *(Aviatsionnaia Tekhnika,* vol 20, no 3, 1977, p 129-131 ) *Soviet Aeronautics,* vol 20, no 3, 1977, p 102-104 Translation

**A79-14849 On calculating the temperature state of film-cooled turbine vanes** V I Lokai, E I Gunchenko, and A V Shchukin *(Aviatsionnaia Tekhnika,* vol 20, no 3, 1977, p 132-135 ) *Soviet Aeronautics,* vol 20, no 3, 1977, p 105-108 11 refs Translation

An analysis of experimental data is used to derive boundary conditions of the third kind (stipulating a local heat transfer coefficient for film cooling and an adiabatic wall temperature) for a turbine blade with film cooling These boundary conditions were used to calculate the thermal stress state (temperature distributions) for such a blade A comparison of computational and experimental

results shows that recommendations in the literature on the establishment of boundary conditions for this problem are inadequate for calculating the thermal states of such blades with required accuracy B J

**A79-14850** **Statistical evaluation of reverser influence on bypass turbojet engine parameters in the forward thrust regime** E D Nesterov, I I Plakhova, and E L Simkin *(Aviatsionnaia Tekhnika,* vol 20, no 3, 1977, p. 135-139 ) *Soviet Aeronautics,* vol 20, no 3, 1977, p 109-112 Translation

**A79-14858** **Basic problem of controlling non-Newtonian fluid flow in roll clearance** V I Elizarov *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 39-45 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 26 31 Translation

The paper considers the problem of controlling the motion of a non-Newtonian fluid (including such aircraft structural materials as plastics, rubber and heat-insulating materials) in the gap between rotating cylinders The controls are parameters of a process in which are satisfied inequality constraints on values of functionals characterizing the pressure of flattening produced by the cylindrical rollers and the deviation of temperature in the gap from a specified temperature A minimax approach is taken to the problem of determining controls B J

**A79-14859** **Unmanned flight vehicle design parameter selection** N G Zaripov and T K Sirazetdinov *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 46-52 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 32-36 6 refs Translation

The paper considers the analytical design of a hypothetical unpiloted flight-vehicle, the problem is posed in terms of a system of ordinary differential equations with inequality constraints on the phase coordinates and controlling parameters The controlling parameters examined are initial thrust conditions, initial load on the vehicle and the operational time of the engine B J

**A79-14863** **Analytic design of airplane automatic pitch controller** T K Sirazetdinov and V K Ivanov *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 73-79 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 53 58 Translation

The paper considers the analytical design of a system for the automatic control of the longitudinal motion of an aircraft that has feedback with respect to angular velocity of pitch and normal acceleration-loading The analysis is based on examination of specific technical constraints on the short-period longitudinal motion of the aircraft An algorithm for realizing the design of the control system is presented B J

**A79-14865** **Airplane wing self-oscillatory bending-torsion vibrations** V I Safronov *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 87 91 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 66 69 8 refs Translation

Safronov's analytical imitation method (1972) is used to investigate the bending-torsional self-oscillations of a wing system that has at least two degrees of freedom It is shown that wing-flutter self-oscillations may undergo synphase self-synchronization B J

**A79-14868** **Aircraft manufacturing quality assurance** A S Shevelev *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 103-108 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 79-83 Translation

The paper investigates the problem of establishing relationships between geometrical and physicomechanical functional parameters and technical factors during the machining of aircraft parts by means of allowance-removal from surfaces The allowance is considered under two aspects as a determinate design-variable and as a random variable This allows refinement of structural formulas for the allowances as well as calculation of operational dimensions Consideration is given to the effect of nonuniformity of the allowance on part quality B J

**A79-14869** **Automatic resonance condition maintenance during multipoint flight vehicle vibration excitation** E A Zharov and V I Smyslov *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 111-114 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 87-89 7 refs Translation

Resonance tests involving multipoint excitation of flight vehicles are performed to measure the frequencies, natural modes, and damping coefficients required in dynamic-strength and aeroelasticity computations A specific feature of such tests is the sustainment of resonance conditions In the present paper, a system which will automatically sustain the resonance conditions is described, and the characteristics of the system's elements are examined Some test results obtained with the system are reviewed V P

**A79-14870** **Optimizing finned pilotless flight vehicle design parameters** N G Zaripov *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 115-118 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 90-93 5 refs Translation

The paper deals with the problem of optimizing the parameters of finned rockets during the preliminary design phase, when the dimensions of the airframe and the power characteristics of the propulsion system have not been definitively established The problem of minimizing the relative fuel mass is solved using a minimax approach The limiting values of the control parameters are determined for specific conditions at the end of the trajectory, which are given in the form of inequalities V P

**A79-14871** **Optimizing linear flight vehicle stabilization systems with orthogonal filters** A I Kaverin *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 118-122 ) *Soviet Aeronautics,* vol 20 no 4 1977, p 94 97 6 refs Translation

Optimization of rocket stabilization systems involves difficulties associated with satisfying the stability conditions for an optimal system (factorization and separation of spectral characteristics and transfer functions) and with the actual implementation of optimal filters The problem is further aggravated when several disturbances are applied to the system In the present paper, it is shown that these difficulties can be surmounted by approximating the required optimal characteristics of the filter by known orthogonal functions with unknown coefficients, and determining the coefficients from the condition of least rms error The rms error is minimized on a digital computer Numerical calculations are carried out for a system with a fourth-order filter, minimizing the rms error with respect to six parameters V P

**A79-14873** **Optimal control of helicopter longitudinal motion on the basis of an operational algorithm** B F Mishnev *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 128 131 ) *Soviet Aeronautics,* vol 20, no 4, 1977 p 104 107 Translation

For a helicopter, automatic pitch control during landing approach is associated with difficulties arising due to considerable changes in the helicopter's aerodynamic performance during this maneuver Linear description of flight dynamics during landing approach does not provide a satisfactory agreement between the model and the actual process In view of this, an attempt is made to develop an automatic pitch control system on the basis of a sufficiently complete nonlinear description of helicopter dynamics An operational algorithm for solving the synthesis problem for an optimal automatic pitch control system is proposed, and its adaptation of an onboard digital computer is examined The transient response of the synthesized system is analyzed V P

**A79-14874** **Airplane takeoff from unpaved airdromes.** V I. Pentiukhov *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 131 136 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 108-111 Translation

The motion of an aircraft rolling on toroidal wheels along soft plastic ground is analyzed An expression for calculating the depth of penetration of the wheels, the resistance to rolling, and the take-off distance as a function of the state of the ground and the load acting

on the wheels is derived within the framework of Babkov et al (1959) theory of the motion of wheeled vehicles along unpaved ground V P

**A79-14876 Optimization of high-aspect-ratio multiweb wing structure** A P Timofeev *(Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 139-142 ) *Soviet Aeronautics,* vol 20, no 4, 1977, p 115-118 Translation

A method of minimum-weight design is proposed for the system of bulkheads in a large-aspect-ratio monocoque wing The optimal law for varying the thickness of the upper and lower panels is formulated The strength of the structure is analyzed within the framework of beam theory Stresses in structural members operating in the plastic range are calculated, along with the permissible stresses in compressed elements A formal-search algorithm for solving the optimization problem is proposed V P

**A79-14974 Aircraft aerodynamic coefficient estimation** N K Gupta, W E Hall, and R L Mohr (Systems Control, Inc , Palo Alto, Calif ) In Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La , December 7-9, 1977, Proceedings Volume 1 Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 296-302 22 refs Navy supported research

The paper reviews advanced statistical and computational techniques used during the last decade to estimate aircraft aerodynamic coefficients from flight test data Topics considered include system identification for aircraft aerodynamic coefficient estimation, preflight test design, post-flight data processing, and model verification Data reconstruction, model structure estimation, and parameter identification are discussed Examples involving input design, instrument analysis, and post-flight data processing are presented M L

**A79-14977 * An information matrix approach for aircraft parameter-insensitive control** D L Kleinman and P K Rao (Connecticut, University, Storrs, Conn ) In Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La , December 7-9, 1977, Proceedings Volume 1 Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 316 325 13 refs Contract No NAS1-14476

The Fisher Information Matrix provides the nucleus of a design procedure for obtaining parameter-insensitive feedback gains in Linear-Quadratic-Gaussian problems The procedure minimizes a sum of performance and closed loop sensitivity costs, the latter being related to the information content of the system response Analytical expressions for the appended cost functional and its gradient with respect to the feedback gains are derived These derivatives serve as the basis of a computationally efficient iterative algorithm that finds the optimal gains Application of the technique is made to determine low sensitivity feedback gains for a C-5A wing loading alleviation system that has 15 states and three uncertain parameters (Author)

**A79-14978 * Information distribution in distributed microprocessor based flight control systems** R C Montgomery (NASA, Langley Research Center, Flight Dynamics and Control Div , Hampton, Va ) and P S Lee (Virginia Polytechnic Institute and State University, Blacksburg, Va ) In Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La , December 7-9, 1977, Proceedings Volume 1 Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 326-335

This paper presents an optimal control theory that accounts for variable time intervals in the information distribution to control effectors in a distributed microprocessor based flight control system The theory is developed using a linear process model for the aircraft dynamics and the information distribution process is modeled as a variable time increment process where, at the time that information is supplied to the control effectors, the control effectors know the time of the next information update only in a stochastic sense An optimal control problem is formulated and solved that provides the control law that minimizes the expected value of a quadratic cost function An example is presented where the theory is applied to the control of the longitudinal motions of the F8 DFBW aircraft Theoretical and simulation results indicate that, for the example problem, the optimal cost obtained using a variable time increment Markov information update process where the control effectors know only the past information update intervals and the Markov transition mechanism is almost identical to that obtained using a known uniform information update interval (Author)

**A79-15016 A nonlinear approach to the design of jet engine control systems** B Sridhar and A J Calise (Dynamics Research Corp , Wilmington, Mass ) In Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La , December 7-9, 1977, Proceedings Volume 1

Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 1181-1185 5 refs

This paper uses a multiple time scaling analysis of jet engine dynamics to derive a nonlinear minimum time control law The ideas are based on concepts taken from singular perturbation theory Further reductions in model order are permitted by this approach, which results in feedback form for the control solution Numerical results are given which compare the accuracy of the solution with open-loop solutions obtained using conjugate gradient and dynamic programming methods (Author)

**A79-15018 Application of an extended Kalman filter to an advanced fire control system** P S Maybeck (USAF, Institute of Technology, Wright-Patterson AFB, Ohio) and R N Lutter (USAF, Avionics Laboratory, Wright Patterson AFB, Ohio) In Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La , December 7-9, 1977, Proceedings Volume 1 Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 1192 1195 12 refs

An extended Kalman filter is developed to aid the tracking of an air-to-air missile from a maneuvering target aircraft The filter exploits knowledge of the dominant aerodynamically induced lift and drag forces of a non-thrusting missile employing proportional navigation guidance The filter provides both dynamic tracking estimates in a local inertial frame and estimates of pertinent parameters including the proportional navigation constant Initial research has established the feasibility of this modeling approach to tracking filter development, and current efforts are fully exploring its performance capabilities The objective is a filter that will provide both accurate, robust tracking estimates and meaningful threat predictive capabilities (Author)

**A79-15020 High angle of attack flight control using stochastic model reference adaptive control** R B Asher (Texas Tech University, Lubbock, Tex ) and D Goebel (BAKWVT, Mannheim, West Germany) In Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La , December 7-9, 1977, Proceedings Volume 1 Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 1203-1210 12 refs

High angle of attack flight control is of utmost importance to military aircraft in air combat maneuvering Flight in this regime have in recent years caused many high performance aircraft to be lost due to departure of the aircraft The aerodynamics in this regime are highly nonlinear The problem is compounded by the fact that the aerodynamics are not well known This paper considers the use of adaptive control in order to perform model following of an 'ideal' aircraft in the presence of uncertain aerodynamic coefficients In particular, the partitioning approach of adaptive control is extended

to the implicit model following problem This is then used to solve the problem of high angle of attack flight control (Author)

**A79-15085 * Development and evaluation of a helicopter-borne water-quality monitoring system** J W Wallace (NASA, Langley Research Center, Hampton, Va), R A Jordan (Virginia Institute of Marine Science, Gloucester Point, Va), J Flynn (Hydrolab Corp, Austin, Tex), and R W Thomas (U S Environmental Protection Agency, Las Vegas, Nev) In Joint Conference on Sensing of Environmental Pollutants, 4th, New Orleans, La, November 6-11, 1977, Proceedings Washington, D C, American Chemical Society, 1978, p 493-499

A small, helicopter-borne water-quality monitoring package is being developed by the NASA/EPA using a combination of basic in situ water quality sensors and physical sample collector technology The package is a lightweight system which can be carried and operated by one person as a passenger in a small helicopter typically available by rental at commercial airports Real time measurements are made by suspending the water quality monitoring package with a cable from the hovering helicopter Designed primarily for use in rapidly assessing hazardous material spills in inland and coastal zone water bodies, the system can survey as many as 20 data stations up to 1 5 kilometers apart in 1 hour The system provides several channels of sensor data and allows for the addition of future sensors The system will also collect samples from selected sites with sample collection on command An EPA Spill Response Team member can easily transport, deploy, and operate the water quality monitoring package to determine the distribution, movement, and concentration of the spilled material in the water body (Author)

**A79-15152 360 deg non-programmed visual display** F J Oharek (U S Naval Training Equipment Center, Orlando, Fla) In Electro Optics/Laser Conference and Exposition, Anaheim, Calif, October 25 27, 1977, Proceedings Chicago, Industrial and Scientific Conference Management, Inc, 1977, p 115 119

The design approach for a large spherical screen laser display system is described Topics considered include the creation of annular images with a probe, the dissection and transmission of annular images, and the reconstruction and projection of annular images to give a nonprogrammed 360 deg visual display The system uses a probe and model board for input imagery The annular projection lens utilized by the system consists of two confocal hyperbolic reflectors to eliminate astigmatism as well as a series of lens groups to eliminate other aberrations Twelve laser channels are scanned with one 24 facet laser scanner operating at 45,000 rpm A hardware feasibility demonstration will test the operation of some features of the system M L

**A79-15153 Visual simulation systems** P R Marr (General Electric Co, Ground Systems Dept, Daytona Beach, Fla) In Electro-Optics/Laser Conference and Exposition, Anaheim, Calif, October 25-27, 1977, Proceedings Chicago, Industrial and Scientific Conference Management, Inc, 1977, p 120-130 5 refs

The paper describes visual image generators and display devices used for visual simulation in the training of vehicle operators Systems considered include the computer image generator in conjunction with visual simulation software, camera model generation, film image generation, and the hybrid image generator Advantages of virtual image display systems and real image display systems are compared M L

**A79-15154 Radar simulation from optical photography** B H Freund (Martin Marietta Aerospace, Orlando, Fla) In Electro-Optics/Laser Conference and Exposition, Anaheim, Calif, October 25 27, 1977, Proceedings Chicago, Industrial and Scientific Conference Management, Inc, 1977, p 131-141

Area correlator navigational guidance systems are described, and the production of scene prediction maps is discussed with attention to the use of radar cross-section as the sensed variable Topics examined include radar prediction maps, reference data base materials, photographic reconnaissance, terrain slope information, reference generation, data base requirements, geometric reconstruction, and feature detection and modification Each image is digitalized by a precision scanning microdensitometer, and feature detection and modification is performed by a specially configured digital image processing system consisting of a computer with 12 million words of disk storage, a digital coordinagraph, and a high-resolution digital television monitor M L

**A79-15156 Multiple laser tracker operations** W W Steele (U S Army, Yuma Proving Ground, Ariz) In Electro-Optics/Laser Conference and Exposition, Anaheim, Calif, October 25-27, 1977, Proceedings Chicago, Industrial and Scientific Conference Management, Inc, 1977, p 151-158

Three laser tracking systems called precision aircraft tracking systems (PATS) comprise the basic position or trajectory measuring instrumentation in the described real-time data collection system PATS are discussed with attention to maintenance, safety, calibration, major sources of errors, and data reduction techniques Real time and batch data reduction schemes are characterized PATS is found to be a useful tracking device for helicopters, fixed wing aircraft, and ground vehicles Applications to the Navstar Global Positioning System, artillery projectile tracking, and tracking at different wave lengths are considered M L

**A79-15159 General principles of automatic video trackers II - Area trackers** F J Thomas and C A Winsor (Martin Marietta Aerospace, Orlando, Fla) In Electro Optics/Laser Conference and Exposition, Anaheim, Calif, October 25-27, 1977, Proceedings Chicago, Industrial and Scientific Conference Management, Inc, 1977, p 184-193

The principles, structure, and applications of automatic video trackers are discussed Techniques for synthesizing tracking signatures from raster scanned video are described, and algorithms for deriving estimates of tracking errors by comparing real time tracking signatures with stored reference signatures are introduced and illustrated with laboratory data The effect of change in sensor footprint (resulting from range closure) upon tracking accuracy is examined, and techniques for minimizing these errors are considered The performance of automatic trackers in tests is indicated M L

**A79-15178 Acousto-optic methods of character generation for aircraft laser displays** H J Aronson (Harmon J Aronson Associates, Wayne, N J) and H Green (U S Naval Material Command, Naval Air Development Center, Warminster, Pa) In Electro Optics/Laser Conference and Exposition, Anaheim, Calif, October 25-27, 1977, Proceedings Chicago, Industrial and Scientific Conference Management, Inc, 1977, p 375-379

A versatile laser display system has been developed as a high intensity device to be used along with a diffractive collimator-combiner lens for a pilot's head up display The system overcomes the lack of brightness inherent in the CRT displays under conditions of high ambient light The system scans a laser beam over a 4 x 4 inch screen with 500 x 500 spot resolution and a position accuracy of 0 0076 inches The maximum scanning rate is about 100,000 inches/sec This rate is achieved during raster scanning at television rates A high performance acoustooptic modulator and deflectors are used as the active elements to control the laser beam Various types of character generation are described including stroke writing, raster, dot matrix, and hybrid character generation S C S

**A79-15205 Assembly and repair of aircraft engine parts using pulsed YAG lasers** R W Beall (Bendix Corp, Energy Controls Div, South Bend, Ind) In Electro Optics/Laser Conference and Exposition, Anaheim, Calif, October 25-27, 1977, Proceedings Chicago, Industrial and Scientific Conference Management, Inc, 1977, p 780-784

Welding small parts of nickel base alloys such as the various inconels 600 and 700 series, hastelloys, Rene 41 and waspalloy, can

present difficulties because of thermal distortion and cracking The purpose of this paper is to familiarize the manufacturing engineer with some commercially available types of pulsed YAG laser welding equipment and its application to these problems (Author)

**A79-15211 Application of shock-tube technology to the measurement of heat-transfer rate to gas turbine components** M G Dunn and F J Stoddard (Calspan Corp , Buffalo, N Y ) In Shock tube and shock wave research, Proceedings of the Eleventh International Symposium, Seattle, Wash , July 11-14, 1977

Seattle, Wash , University of Washington Press, 1978, p 56-65 17 refs Contract No F33615-76-C-2092

A portion of the first-stage stationary inlet nozzle of the TFE-731-2 engine has been instrumented and tested The experimental apparatus consisted of a helium-driven shock tube (as a short-duration source of high-temperature) and a high-pressure gas, driving a nozzle-test-section device mounted near the exit of a primary shock-tunnel nozzle and extending into the shock-tunnel receiver tank The nozzle-test-section device consists of a forward transition section with a circular opening facing the supersonic primary nozzle flow and with the external shape of a frustum of a cone Internal contouring is provided to transform the circular-section subsonic intake flow into one filling a 176-degree annular segment having a geometry approximating that of the entrance to the turbine stator stage in a turbojet Detailed measurements of static pressure in the test section and heat-transfer rate on the stator sector have been obtained (Author)

**A79-15351 Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings** Symposium sponsored by IEEE, IES, ASME, ASQC, System Safety Society, AIAA, AIIE, and S O L E New York, Institute of Electrical and Electronics Engineers, Inc , 1978 557 p Members, $16 , nonmembers, $24

Models of reliability and maintainability of systems are studied, and reliability concepts, attitudes, and policies are described Topics discussed include logistics supportability testing, Air Force experience with reliability improvement warranties (RIW), time series analysis of failure data, contractor risk associated with RIWs, mechanical reliability for low cycle fatigue, effects of on-off cycling on equipment reliability, a life-cycle management cost model, fault-tree analysis with probability evaluation, computer-graphic design for human performance, and early identification of high-maintenance helicopters P T H

**A79-15359 Tacan RIW program** A J Hauter and C W Strempke (Rockwell International Corp , Collins Avionics Group, Cedar Rapids, Iowa) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 62 65

For Tacan, the reliability improvement warranty (RIW) program means a fixed price per unit delivered, a field MTBF requirement, and a fixed price to repair all returned equipment for a period of five years from date of first equipment delivery for two years from date of last delivery In addition to the penalty of additional repair cost to the contractor if the MTBF was not achieved, there are also the additional penalties of (1) consignment of spares if the guaranteed MTBF is not met and (2) price adjustments for repair turnaround time greater than specified The paper summarizes the reliability demonstration tests and field MTBF results for the Tacan program P T H

**A79-15360 RIW data collection and reporting method** R C Day and L E McIntyre (Lear Siegler, Inc , Instrument Div , Grand Rapids, Mich ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17 19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 66-72

RIW Programs with or without an MTBF guarantee usually contain a requirement for RIW data This paper explains the different types of reports that can be beneficial to both the contractor and the military A description of raw data requirements, their sources, and the formulas used to produce the summary reports will be given Operation of the USAF's Autodin System will be explained (Author)

**A79-15369 Designing-in reliability - A new approach** J A Tazartes (Litton Systems, Inc , Woodland Hills, Calif ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 130 135

This paper describes the new approach used to design reliability, maintainability and producibility in the Litton F 18 Inertial Navigation System The principles and operation of the In-Process Design Analysis concept are described Particular emphasis is placed on the fact that reliability and maintainability cannot be considered as isolated disciplines, but instead are to be regarded as part of a complete body of interrelated disciplines to be implemented as a complete package The role of the Design Analysis group (Design guidelines, Designer R&M education, Past Problem avoidance, Trade-offs, Analysis definition and Approval) is discussed Three design phases are then successively examined for goals, procedures and results Results of the In-Process Design Analysis phase indicate that the hundreds of improvements already introduced in the design by this procedure will lead to a considerably more reliable and more maintainable system (Author)

**A79-15371 Flight control safety - A total systems approach** J W Davison, G L Fileccia (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio), K A Fudge, L S Gephart (Dayton, University, Dayton, Ohio), and H G Tinsley (FAA, Washington, D C ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 143 150

A total systems analysis procedure is developed for the identification of the safety hazards or risks associated with the use of a defined flight control system for a low visibility (Category III) approach and landing The analysis includes the ground transmitting system with monitoring, the airborne automatic flight control system, and both the pilot and crew procedures Probabilistic estimates of the overall safety for the example of the C 141 test aircraft were determined via a basic decision tree model and a sensitivity analysis B J

**A79-15373 Analysis of the economic benefits of utility helicopter safety design features** J E Hicks (U S Army, Agency for Aviation Safety, Fort Rucker, Ala ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17 19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 157-161 6 refs

An analysis of the economic benefits of providing crashworthiness and other flight safety improvements within future Army utility helicopters is discussed The analysis is based on a study of Army/Bell Helicopter UH-1H aircraft accident reports and projects future accident losses for a number of candidate utility helicopter designs Losses are projected for a twenty year period of peacetime operation Projections are derived based on each candidate's design features and the effectiveness of these features in accident/injury prevention under the particular circumstances in each UH-1H accident (Author)

**A79-15374 Economics of commercial aviation safety** H W Wynholds (ECON, Inc , San Jose, Calif ) and L Rass (Caputo, Liccardo, Rossi and Sturges, San Jose, Calif ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 162-166 29 refs

This paper addresses the fundamental issues of commercial aviation safety and economics for an industry that provides a service (transportation) for which there is a cost of production and a value of that service The issue of just which level of safety best promotes the public interest can then be argued It is shown that fundamental societal value judgements must be solved in order to determine the degree of commercial aviation safety that is socially optimal It is also suggested that considerable care is required to arrive at an optimal social policy due to the complexity presented by the interaction of the regulated airlines and the relatively unregulated aircraft manufacturers Highly simplified models may be useful in delineating some of the issues in these more complex and realistic problems of safety, economics and regulation (Author)

**A79-15379** **Time-dependent failure rates for jet aircraft** M B Shurman (Boeing Aerospace Co , Logistics Support and Services Div , Seattle, Wash ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 198-203 10 refs

Extensive field experience data show that airplane failure rates decrease with sortie elapsed flight time The data are used to develop an empirical failure rate equation The time dependent behavior may be explained by the changing environment, especially in a sortie's initial phases, and occurs on every sortie This failure rate model is used to derive new equations for reliability, probability density function, expected number of failures after t hours of flight, MTBF, availability, and expected time of failures (given that a failure occurred) The model's realism is demonstrated by comparing its predictions with newly acquired E 3A (AWACS) and B-52 field experience data Finally, there is a discussion of the model's implications on reliability flight test demonstrations, the phrasing of reliability and reliability related requirements in RFPs and specifications, the formulation of environmental test requirements for qualification and burn-in of airplanes and their subsystems, life cycle cost models, and reliability improvement warranties (Author)

**A79-15382** **Operational influences on maintainability** L J Phaller (Westinghouse Electric Corp , Baltimore, Md ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 218-221

Historical data collected by both DOD and its equipment suppliers on ground-based electronic equipment has shown that a large disparity exists between predicted and field recorded maintenance times A study conducted on four ground electronic equipments demonstrated that there are two general categories of influences that cause this disparity those attributable to the manufacturer and those attributable to the operational environment It is found that operational factors comprise as much as 84% of the total disparity B J

**A79-15385** **Operational influence on avionics reliability** G A Kern (Hughes Aircraft Co , Culver City, Calif ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17 19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 231-242 11 refs USAF sponsored research

The effect of operational influences on the reliability of airborne avionics equipment was studied The primary objectives were (1) to identify the significant factors that influence the reliability of USAF avionics equipment, and (2) to develop mathematical models which relate these factors to the demonstrated, required, and field-operational reliability results Developmental and operational performance histories of 16 different avionics equipments were examined, several of the equipments had been used on two or more aircraft, so that performance differences could be compared Recommendations for more consistent reliability assessment methods are presented, and the mathematical models are described M L

**A79-15391** **RPM - A recent real life case history** J M Clarke and W P Cougan (General Electric Co , Aerospace Electronic Systems Dept , Utica, N Y ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 279-285

This paper presents a result-oriented case history of a reliability growth and demonstration test program conducted for a complex airborne surveillance radar processing system under Combined Environmental Reliability Test (CERT) conditions The reliability growth or Test Analyze-And Fix (TAAF) test plan was dimensioned in accordance with the methodologies presented by Selby and Miller (1970) and by Duane (1964) The paper describes in detail the significant elements of the test program including TAAF planning methods, the actual time-related pattern of growth test failure precipitation and the effects of changing CERT conditions, the method of implementing an effective closed-loop corrective action system, approaches taken to determine the achieved reliability growth level, and finally, the reliability demonstration test results (Author)

**A79-15402** **The F/A-18 challenge - Readiness and low total cost** C M Mitchell (U S Naval Air Systems Command, Washington, D C ), J P Capellupo, and R L McGee (McDonnell Douglas Corp , St Louis, Mo ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 412-416

The F/A-18 'Hornet' strike fighter represents the next generation aircraft to be introduced into the Navy inventory This paper summarizes some of the reliability and maintainability activities of the program with attention given to Hornet design and program decisions, the stores management set, the inertial navigation set, the HUD, ground power switching, the radar, and the engines The integrated test plan for the Hornet is described along with the operational mission environment and demonstration testing B J

**A79-15403** **Cost and operational effectiveness of R&M improvements** S J Blewitt (Boeing Vertol Co , Philadelphia, Pa ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 417 421

The Boeing Vertol Company completed a study under contract to the U S Army Air Mobility Research and Development Laboratory (USAAMRDL), to develop a technique for evaluating the cost and operational effectiveness of potential aircraft modifications that affect reliability and maintainability The methodology considers the vehicle changes in the context of a task accomplishment approach, that is, the change is evaluated in terms of its effect on the aircraft's ability to perform a specific mission The evaluation technique is easily usable by those involved in the decision-making process (Author)

**A79-15404** **Cost effective improvement of the timeless C-130 Hercules airlifter** J J Duhig, Jr and J L South (Lockheed-Georgia Co , Marietta, Ga ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 422 427 6 refs

The program used for identifying and implementing cost effective technology improvements for the C-130 Hercules is described Improvement goals encompassing reliability, maintainability, productivity, and mission capability are defined, and a four step product upgrading plan is outlined The methods and techniques used in developing and evaluating improvement alternatives are discussed and examples of recent modernization changes are presented Tracking charts display the effectiveness of the C-130 upgrading effort Significant progress towards achievement of cost effective improvement goals is shown (Author)

**A79-15410** **Maintainability by design** J M Wellborn and G W Lawson (General Electric Co , Lynn, Mass ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17-19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 478-485

The planning of maintainability for the T700-GE-700 turboshaft engine is described Evolution and design for maintainability are traced from the demonstrator program through the official model qualification test demonstration Attention is directed to maintainability management and to management treatment of quantitative and qualitative requirements It is suggested that the development of a truly maintainable engine requires that maintainability be given a consistent high priority M L

**A79-15411** **Early identification of high-maintenance helicopters** T R McCreary (Bell Helicopter Textron, Fort Worth, Tex ) In Annual Reliability and Maintainability Symposium, Los Angeles, Calif , January 17 19, 1978, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1978, p 486-491 10 refs

This study describes a method of predicting which helicopters within a given fleet will require an unusually large amount of maintenance during the life cycle Parameters have been identified which, when combined into a 'cluster analysis' type of algorithm, correlate with those helicopters that will require high maintenance (Author)

**A79-15460** **Bearing errors in the VHF omnirange due to scattering from wires** H Gruenberg (Syracuse University, Syracuse, N Y ) *IEEE Transactions on Antennas and Propagation,* vol AP-26, Nov 1978, p 810 819 7 refs U S Department of Transportation Contract No FA73WA-3272, Contract No F30602-C 0121

Scattering from obstacles in the vicinity of a VHF omnirange can cause bearing errors in aircraft receivers A general formula is developed for the bearing error due to an arbitrary scatterer in terms of its scattering radiation pattern The theory is then applied to get specific results for a long horizontal wire The current distribution on the wire, the scattered field, and the bearing error are computed by a transform method, and all integrals are evaluated asymptotically by the saddle point method The final result clearly shows the dependence of the bearing error on all system parameters The theoretical conclusions are all found to be consistent with the results of numerous experiments carried out by the Federal Aviation Administration (FAA) Some results and speculations are presented for multiwire lines (Author)

**A79-15540** # **Fibre composite reinforcement of cracked aircraft structures** A A Baker and M M Hutchison (Department of Defence, Aeronautical Research Laboratories, Melbourne, Australia) In Reinforced Plastics/Composites Institute, Annual Conference, 33rd, Washington, D C , February 7 10, 1978, Proceedings New York, Society of the Plastics Industry, Inc , 1978, p 17-E 1 to 17-E 8

The fatigue performance of a range of commercially available adhesive materials has been examined to enable the selection of an adhesive system suitable for bonding of fibre composite reinforcements to cracked aircraft structures Small constant stress cantilever 7075-T6 aluminum alloy fatigue specimens were used to evaluate the characteristic of the adhesives and also to examine the feasibility of using fibre composites to control crack propagation The adhesives selected for the repair application required curing at 130 C which, due to the low thermal expansion of the composite, induced residual tensile stresses in the aluminum at room temperature Wedge-loaded, precracked stress-corrosion specimens were used to show that these internal stresses do not significantly limit the practical usefulness of the proposed repair schemes Finally, three practical aircraft repairs are described, two of which are currently being evaluated under operating conditions (Author)

**A79-15559** **California airport monitor noise data** S R Lane (Science Applications, Inc , McLean, Va ) and R Procunier (U S Environmental Protection Agency, San Francisco, Calif ) In Inter noise 78 Designing for noise control, Proceedings of the International Conference, San Francisco, Calif , May 8 10, 1978 Poughkeepsie, N Y , Noise Control Foundation, 1978, p 739-742

The study determines whether noise level readings vary from one monitoring system to another, given that the same acoustic event occurs at each system Another major objective is to compare the average operational noise level for a particular aircraft type with the type certification data often used as a basis for predicting average aircraft noise levels in airport communities The study is conducted for the DC 9 aircraft at five airports currently operating automatic noise monitoring systems, but the comparative study is restricted to San Jose and Orange County The question is raised as to whether certification flight operations and thus certificated noise levels represent the in-service operations and the real noise exposure at airports, or whether the aircraft delivered to the airlines are equivalent to the particular aircraft that is certified S D

**A79-15569** **Boeing's noise technology facilities** C D Simcox (Boeing Commercial Airplane Co , Seattle, Wash ) In Inter noise 78 Designing for noise control, Proceedings of the International Conference, San Francisco, Calif , May 8-10, 1978 Poughkeepsie, N Y , Noise Control Foundation, 1978, p 983 998 6 refs

The paper describes the individual test facilities constituting a complete laboratory for supporting the entire spectrum of noise technology development and testing associated with modern commercial transport aircraft The capability exists to conduct research and development on noise reduction techniques for isolated noise components, to evaluate and demonstrate suppression concepts on engine and aircraft, to support customer related problems, and to conduct flyover and certification testing Attention is given to the large anechoic test chamber, turbomachinery test facility, acoustic material test center, anechoic/reverberant chambers, quiet air facility, model jet flow facility, low-speed acoustic wind tunnel, glider airframe noise facility, and full scale demonstrators The schematic of the acoustic data processor system is briefly discussed P T H

**A79-15664** **Stability and pressure measurements in the Naval Surface Weapons Center hypervelocity tunnel** J A F Hill (U S Navy, Naval Surface Weapons Center, Silver Spring, Md ) In ICIASF '77, International Congress on Instrumentation in Aerospace Simulation Facilities, 7th, Shrivenham, England, September 6-8, 1977, Record New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 113-124 5 refs

The hypervelocity tunnel at the Naval Surface Weapons Center (White Oak Laboratory) is a new facility designed to provide a unique capability for hypersonic tests at high Reynolds numbers The run time is about 1 5 seconds of which 0 5-0 7 seconds represent usable test time Techniques are described for obtaining both stability and pressure-distribution data while pitching the model up to 30 degrees during this time Conventional strain-gage balances are used to obtain stability data The principal problem is to eliminate the effects of sting-balance-model oscillations from the data record Experiences with both analog and digital filters are reported Pressure measurements are made with transducers mounted inside the models and connected to the pressure orifices with short lengths of tubing A criterion has been developed for selecting tubing diameters which produce a fast but nonoscillatory response Stability and pressure data obtained on sharp and blunted cones are presented Excellent agreement has been obtained both with theory and with data obtained at fixed incidence (Author)

**A79-15665** * **A dynamic calibrating apparatus for cross derivative experiments** E S Hanff (National Aeronautical Establishment, Ottawa, Canada) In ICIASF '77, International Congress on Instrumentation in Aerospace Simulation Facilities, 7th, Shrivenham,

England, September 6-8, 1977, Record New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 125-134 5 refs Contract No NASw-2780

A calibrating apparatus intended to verify the validity of the methodology employed for the determination of aerodynamic cross and cross-coupling moment derivatives has been developed and successfully tested It has so far been used in the cases of pitching, yawing and plunging oscillation and is soon to be utilized to verify the approach employed in the determination of cross derivatives due to rolling The apparatus is based on the substitution of generally unpredictable aerodynamic moments by accurately known electromagnetically induced ones that can then be used to verify the correctness of the methods used for the determination of derivatives (Author)

**A79-15769 The implementation and practical verification of a superposition method for the solution of elastic crack problems** P Bartholomew (Royal Aircraft Establishment, Farnborough, Hants , England) In Numerical methods in fracture mechanics, Proceedings of the First International Conference, Swansea, Wales, January 9-13, 1978 Swansea, Wales, University College of Swansea, 1978, p 336 349 14 refs

The paper demonstrates a superposition method which provides a practical and efficient method for the solution of linear elastic crack problems The method approximates the linear elasticity solution over a substructure containing the crack tip by the superposition of appropriate singular stress fields and a relatively coarse finite element mesh A hybrid variational principle is employed to ensure displacement compatibility between this substructure and adjoining ones employing finite elements alone A key feature of the method is that it may be implemented by adding routines to existing finite element packages The particular implementation discussed here is intended for use in the aircraft industry (Author)

**A79-15794 # Finite element analysis of fatigue crack growth in aircraft components** J Backlund and S Sjostrom (Linkoping Institute of Technology, Linkoping, Sweden) In Numerical methods in fracture mechanics, Proceedings of the First International Conference, Swansea, Wales, January 9-13, 1978
Swansea, Wales, University College of Swansea, 1978, p 787-797 8 refs

The growth of surface cracks in three-dimensional bodies subjected to spectrum loadings and the residual strength of such bodies have been computer-simulated Crack propagation was simulated using Forman's law on the basis of stress intensity factors deduced from FEM obtained strain energies Reasonable agreement with experimental data was obtained both for crack propagation and residual strength B J

**A79-16010 Topics in fluid film bearing and rotor bearing system design and optimization, Proceedings of the Design Engineering Conference, Chicago, Ill , April 17-20, 1978** Conference sponsored by the American Society of Mechanical Engineers Edited by S M Rohde (GM Research Laboratories, Warren, Mich ), P E Allaire (Virginia, University, Charlottesville, Va ), and C J Maday (North Carolina State University, Raleigh, N C ) New York, American Society of Mechanical Engineers, 1978 277 p Members, $15 , nonmembers, $30

Studies ranging from bearing analysis to shaft optimization in rotating machinery are considered The discussion focuses on fluid film bearing analysis, squeeze film damper analysis, rotor-bearing systems, and optimization of rotor-bearing systems Papers are presented which reflect the emphasis in the current literature on the dynamics of journal bearings Studies of the stiffness and damping coefficients as well as general dynamic shaft motions are described Several papers address the design of fluid film bearings for minimum parasitic power loss Sophisticated analyses of squeeze film dampers used in both large-scale industrial turbomachinery and high-speed jet aircraft-type engines are presented which allow their performance in real machinery to be predicted with confidence A high level of modeling capability is being reached in the analysis of complex rotor bearing systems S D

**A79-16012 The influence of tilting pad bearing characteristics on the stability of high speed rotor-bearing systems.** J C Nicholas, E J Gunter, and L E Barrett (Virginia, University, Charlottesville, Va ) In Topics in fluid film bearing and rotor bearing system design and optimization, Proceedings of the Design Engineering Conference, Chicago, Ill , April 17 20, 1978 New York, American Society of Mechanical Engineers, 1978, p 55-78 20 refs

This work develops a computer design optimization for tilt pad bearings A stability analysis is carried out for an 11-stage centrifugal compressor supported by eight geometrically different pairs of 5-pad tilt pad bearings The compressor represents a typical class of machine with a relatively flexible shaft often encountered in industry The zero preloaded, centrally pivoted, load on pad bearing design provides the best stability characteristics to the compressor Increasing preload and/or offset from this design decreases stability Pad loading makes little difference at high Sommerfeld numbers From the results of the stability analysis, a stability parameter is deduced that provides a quick design guide to machine stability for tilt pad bearings A critical speed and unbalance response analysis is undertaken for the compressor with the zero preload, centrally pivoted, load on pad bearings This bearing design also provides good unbalance response characteristics to the compressor system (Author)

**A79-16078 # Development of an environmental design and test guide for Army rotary-wing aircraft** D R Artis, Jr (U S Army, Applied Technology Laboratory, Fort Eustis, Va ) In Combined environments Technology interrelations, Proceedings of the Twenty fourth Annual Technical Meeting, Fort Worth, Tex , April 18 20, 1978 Mount Prospect, Ill , Institute of Environmental Sciences, 1978, p 10-15 6 refs

The first draft of an environmental design and test guide for Army rotary wing aircraft will be prepared and coordinated with professional societies The guide will elaborate upon the following general observations (1) the single most influential environmental elements affecting mission aborts are rain and low temperature for attack aircraft, icing for cargo aircraft, low temperature for observation aircraft, and icing for utility aircraft, and (2) the single most influential environmental elements affecting flight safety were rain for attack aircraft, rain, soil particles, and low temperature for observation aircraft, and soil particles for utility aircraft B J

**A79-16087 # The perils and pitfalls of low-cost vibration alternatives - Practical experience with pneumatic exciters for production screening** H Caruso (Westinghouse Product Qualification Laboratory, Pittsburgh, Pa ) In Combined environments Technology interrelations, Proceedings of the Twenty-fourth Annual Technical Meeting, Fort Worth, Tex , April 18-20, 1978 Mount Prospect, Ill , Institute of Environmental Sciences, 1978, p 66-69 5 refs

**A79-16092 # The integration of airport planning and environmental assessment - A focus on air quality analysis** K M Chng (Bolt Beranek and Newman, Inc , Cambridge, Mass ) and K B Alschuler (Skidmore, Owings and Merrill, Boston, Mass ) In Combined environments Technology interrelations, Proceedings of the Twenty-fourth Annual Technical Meeting, Fort Worth, Tex , April 18-20, 1978 Mount Prospect, Ill , Institute of Environmental Sciences, 1978, p 139-148 6 refs

The paper describes the opportunities for the effective use of environmental information at all levels of airport planning and focuses on specific examples in the area of air quality assessment and air pollution mitigation The environmental assessment is performed in terms of a problem-oriented approach to the transportation planning process Pollution prediction models are discussed for such

specific emission sources as aircraft, automobiles, service vehicles, and power plants and incinerators Pollution abatement technology and mitigating measures are briefly reviewed B J

**A79-16111** # **Aircraft structural reliability prediction based on dynamic loads and ultimate strength test data** H B Chenoweth (Rockwell International Dynamics Laboratory, Los Angeles, Calif ) In Combined environments Technology interrelations, Proceedings of the Twenty-fourth Annual Technical Meeting, Fort Worth, Tex , April 18-20, 1978 Mount Prospect, Ill , Institute of Environmental Sciences, 1978, p 352-356 8 refs

A method for predicting aircraft structural reliability is developed based on USAF static test records of major components between 1950 and 1970, and various selected dynamic load distributions The prediction method uses the Lustig static test failure sample to derive a strength failure probability distribution Predictions are analyzed using dynamic distributions derived from atmospheric turbulence and maneuver load information The resulting data enable the reliability estimation of aircraft structures under actual or projected dynamic loads B J

**A79-16157** # **Navigation planning - Need for a new direction** W W Bailey (General Accounting Office, Washington, D C) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 3-8

Consideration is given to various currently used navigation systems, such as VOR, Tacan, Loran A and D, Omega, and Doppler radar systems An alternative plan is developed where the 13 currently used navigation systems are divided into three categories needed systems, potentially needed systems, and unneeded systems The needed systems, i e , Navstar, inertial and Doppler radar, and marine nondirectional beams, are described in terms of coverage and accuracy, reliability, military needs, and costs Recommendations are made for the development and implementation of a single, government-wide navigation planning agency S C S

**A79-16158** # **Aeronautical aspects of the DOT National Plan for Navigation** A Goldsmith (U S Department of Transportation, Washington, D C ) In Air navigation Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 19-21

The National Plan for Navigation (NPN) of the Department of Defense is discussed noting the executive summary, the responsibil ities of the associated government agencies, and the major navigation systems which will be incorporated The primary federally provided systems for civil navigation are identified for marine, aeronautical, and land applications Air navigation systems are further discussed noting inertial and Doppler radar systems supplemented by Loran-A or Omega, VOR DME/Tacan systems, radiobeacons, and instrument landing systems Systems for off-airway operations are presented S C S

**A79-16159** # **Navigation systems for USAF aircraft through the year 2000** P J Logus and H W Underwood (USAF, Aeronautical Systems Div , Wright-Patterson AFB, Ohio) In Air navigation Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 27-31 22 refs

The types of inertial and radio navigation systems which will be used for the U S Air Force through the year 2000 are discussed, noting the historical development of such systems Inertial systems are considered with reference to accuracy and the required gravitational field information, reaction time, design, and equipment integration with other sensors The Navstar/Global Positioning System is described with reference to its accuracy, areas of risk, and procedures for decreasing the potential for energy jamming Brief mention is also made of data-link systems, microwave landing systems, and VHF/UHF instrument landing systems S C S

**A79-16160** # **Helicopter navigation goals** G A Gilbert In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 35-37

Helicopter operations are discussed with reference to basic weather criteria and areas and types of operations Airborne radar instrument approaches involved in helicopter operations are discussed, including operations at offshore oil rigs and production platforms, operations at surface and elevated heliports, operations in remote areas, and operations in disaster areas Procedures for determining the location of the touch-down zone of a landing area are noted such as radar imaging of a readily identifiable object, beacon installations, and mobile, self contained beacon systems Methods for augmenting airborne radar instrument approaches are suggested S C S

**A79-16161** # **VOR - Its past, present, and future** R B Flint (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 38-49 111 refs

The development of VHF Omnidirectional Range (VOR) is outlined with reference to system testing Polarization selection is discussed noting that vertical polarization was selected on 125 MHz Ground station equipment consists of a VHF transmitter, modulation eliminator, antenna system, and double-bridge circuit Several antenna systems (including elevated and stacked configurations) are described and calibration procedures are noted The design of Doppler VOR systems is presented S C S

**A79-16162** # **Flight profile investigation for microwave landing system** T J Emerson (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 50-57

The paper addresses pilot and aircraft interface with microwave landing systems A flight profile investigation program has been developed in three phases (1) pilot-in-the-loop simulation, (2) flight testing using two modified T-39 aircraft, and (3) flight experimentation emphasizing pilot acceptance of nonconventional instrument meteorological conditions Horizontal tracking performance has been analyzed in three parts (1) the initial approach segment, (2) the crosstrack or intermediate approach segment, and (3) the final approach segments and capture S C S

**A79-16163** # **Loran-C - A potential civil aviation navigation system** R H Cassis, Jr (U S Coast Guard, Office of Research and Development, Washington, D C ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 58-70 9 refs

The paper discusses the Loran-C system, a pulsed hyperbolic navigation instrument operating in the 90-110 kHz band Position is determined on the basis of radiated power, atmospheric noise, and the geometric relationship of the transmitter and receivers The Loran-C chain can provide geodetic accuracy to within 0 25 NM Two types of Loran-C user equipment are presently available a fully automatic receiver designed to transfer time and difference readings visually or digitally, and a complete navigation system incorporating a receiver and flight computer in the same equipment S C S

**A79-16164** # **Automated OMEGA/VLF monitoring and forecasting for air traffic safety enhancement - A progress report** E R Swanson (U S Naval Ocean Systems Center, San Diego, Calif ) and P H Levine (*Megatek Corp , San Diego, Calif* ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 71-78 10 refs

Attention is given to the use of OMEGA/VLF systems for monitoring and forecasting in order to increase air traffic safety The conceptual design of an automated monitor system is presented This concept is developed for a prototype system consisting of an Omega receiver, digital interface, digital processor, control display unit, and alerting display unit The input/output procedures are presented and the archived data base and software structure are described S C S

**A79-16165** * # **Can low cost VOR and Omega receivers suffice for RNAV - A new computer-based navigation technique** L A Hollaar (Illinois, University, Urbana, Ill ) In Air navigation Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978

Washington, D C , Institute of Navigation, 1978, p 79-82 5 refs Research supported by the University of Illinois, Contract No NAS1-15145

It is shown that although RNAV is particularly valuable for the personal transportation segment of general aviation, it has not gained complete acceptance This is due, in part, to its high cost and the necessary special-handling air traffic control VOR/DME RNAV calculations are ideally suited for analog computers, and the use of microprocessor technology has been suggested for reducing RNAV costs Three navigation systems, VOR, Omega, and DR, are compared for common navigational difficulties, such as station geometry, siting errors, ground disturbances, and terminal area coverage The Kalman filtering technique is described with reference to the disadvantages when using a system including standard microprocessors An integrated navigation system, using input data from various low-cost sensor systems, is presented and current simulation studies are noted S C S

**A79-16166** # **GPS for civil aviation - A new approach to improved civil air operations** J J Kishel (Teledyne Systems, Northridge, Calif ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 83 89

The future impact of the Global Positioning System (GPS) on civil air operations in the 1990s and beyond is considered GPS operation is outlined and compared to that of the Loran system It is noted that GPS accuracy is based on the availability of low-cost, airworthy oscillators Several applications of GPS in civil air operations are reviewed, including the phased introduction of GPS into air traffic control, GPS/RNAV systems, closed-loop air traffic control with GPS, and GPS as used for collision avoidance S C S

**A79-16167** # **GPS multipath error model** M A Khalil (Mitre Corp , McLean, Va ) In Air navigation Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 90-94 5 refs U S Department of Transportation Contract No FA78WA-4075

A Global Positioning System (GPS) error model has been developed for estimating the potential performance of a low-cost airborne pseudo-random noise code sequential receiver used for civil aviation The effective interaction of pseudo-random noise modulated waveforms with multipath in a noncoherent processor is characterized by the multipath amplitude and the phase characteristic functions Multipath effects on signal acquisition and range tracking error are evaluated as functions of the signal-to-noise ratio, direct to-multipath ratio, multipath delay, and Doppler shift Numerical results have been obtained for both en-route and terminal phases of flight for typical geometries and channels The data show that strong multipath interference could cause significant delays in signal acquisition and large tracking errors if low-cost GPS receivers operate at marginal signal-to-noise levels S C S

**A79-16169** # **A technical update on satellites for aircraft communication and surveillance** R E Anderson (General Electric Co , Schenectady, N Y ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 99-106 9 refs

The paper outlines aircraft equipment results obtained during the 1968-1971 period in conjunction with NASA's ATS-1 and ATS-3 satellites, FAA DC-6B and C-135 aircraft, and a commercial service aircraft Results are discussed in terms of transmission link reliability, ionospheric scintillation, and tone-code ranging at VHF Experiments conducted with an automobile equipped with a VHF transmitter and receiver and tone-code ranging responders are described with reference to two-way voice communications through satellite links Consideration is given to tone-code ranging studies and surveillance with a one-active-repeater satellite Tone-code ranging and position determination at L-band, tested with the ATS-5 and ATS-6 satellites and compared to NASA's C-band tracking system is reviewed Observations of ionospheric effects on satellite-to-earth communications are briefly noted S C S

**A79-16171** # **Navigational systems requirements via collision risk model** A Busch and B Colamosca (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 113-118 5 refs FAA-supported research

The derivation of the minimum navigational performance standard (MNPS) for the North Atlantic is discussed Attention is directed to the collision risk methodology used in its derivation The risk associated with the system is described Implications of MNPS for navigation system design and certification are examined, and the extension of the North Atlantic region MNPS concept to other airspace is considered M L

**A79-16172** # **Evolution of area navigation in the air traffic control system** R Cassell (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 119-125 14 refs

A scenario for an increase of use of area navigation in the air traffic control system (ATC) is discussed Station referenced and self-contained systems are considered, and area navigation systems providing horizontal guidance only (referred to as RNAV), vertical as well as horizontal (VNAV), and time as well as space guidance (TNAV) are distinguished Results of area navigation studies, tests, and simulations are examined with attention to problems deterring widespread use of area navigation Suggested operational interfaces with present and future ATC systems are described, and some examples of area navigation operational applications are presented M L

**A79-16174** # **Cockpit displays for advanced navigation - Circa 2000** D Eldredge (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 135-140 9 refs

The paper deals with the present test work concerning the outline of air carrier cockpit and navigation system displays as they will appear by the year 2000 Electronic flight instruments and other displays for engine performance, aircraft systems, and presentation of warning and checklist information appear to be highly likely as replacements for the present multiplicity of display types, sizes, and

locations Multiple mode usage and interchangeability for redundancy will provide a major reduction in cockpit clutter, installation, and maintenance costs and pilot work loads The most controversial aspect of future navigation displays relates to the terminal phase for which head-up displays have been advocated V P

**A79-16176** # **Airlines long-range navigation assessment** T G Angelos (United Air Lines Flight Training Center, Denver, Colo ) In Air navigation - Today and in the year 2000, Proceedings of the National Aerospace Symposium, Atlantic City, N J , April 25-27, 1978 Washington, D C , Institute of Navigation, 1978, p 148-150

The Task Force formed by the U S airlines is fully aware of the work now underway to develop a satellite based navigation system to replace the present Vortac system in fulfilling military requirements It is recognized that military systems may offer navigational improvements, such as more accurate means of altitude measurement, however, the system being developed for military long-range navigation need not be the most suitable long-term solution for civil navigation The potential of the military navigation system for meeting certain stated civil navigation requirements should be investigated V P

**A79-16228** # **Advanced turbine powerplants for future helicopter systems** P P Peluso, Jr (Avco Corp , Avco Lycoming Div , Stratford, Conn ) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 12 p

Significant advancements have been made since the mid-1960s by Avco Lycoming in small turbine engine design through component technology programs specifically addressed to the 5-10 pound per second airflow size This paper reviews the development background, design criteria, performance objectives, and program status for two distinct engine configurations the LTS 101 turboshaft engine and ATDE (Advanced Technology Demonstrator Engine) The ATDE engine represents configuration tradeoff studies biased in favor of exceptional performance, while the design of the 101 engine family has evolved from tradeoff studies emphasizing simplicity, and minimum cost of ownership B J

**A79-16229** # **Rotorcraft technology for the year 2000** R R Lynn and W G O Sonneborn (Bell Helicopter Textron, Fort Worth, Tex ) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 11 p

Consideration is given to rotorcraft R & D with reference to the following development goals improved aerodynamic performance, lower life-cycle cost/no scheduled maintenance, reduced vibrations, and mission-tailored handling qualities In addition, attention is given to the projected design of helicopter transmissions for the year 2000 and to the STAR concept, in which quintuple actuators are used to position a rise/fall swashplate The use of advanced composite materials and structures in helicopter design and the development of advanced VTOL configurations are also examined B J

**A79-16232** # **New technological advances in the development of helicopter turbine powerplants for the 1980's (Neue technologische Forderungen an Turbinen-Triebwerken von Hubschraubern fur die 80er Jahre)** W J Crawford, III (General Electric Co , Aircraft Engine Group, West Lynn, Mass and Cincinnati, Ohio) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 28 p In German

After a review of some system design considerations relating to helicopter powerplant design, the paper examines in detail the development of the T700 turbine powerplant Basic design goals for the T700 program are reviewed and the T700 system is compared with the older-generation T58 system in terms of overall design, intake system, compressor, combustion chamber, and gas generator Considerations relating to the reliability, maintainability, modularity of construction, ease of assembly, and fuel efficiency of the T700 system are presented B J

**A79-16233** # **Integrated computer-display system for modern anti-tank/combat helicopters** T C Suvada (Kaiser Aerospace and Electronics Corp , Palo Alto, Calif ) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 15 p

The integrated display concept as it applies to antitank helicopters is described, with particular reference to the AH-64 advanced attack helicopter and the AH-1S Cobra helicopter CRT head down displays, head up displays, helmet displays, and helmet sighting systems, and their corresponding symbol generators, are used to display to the pilot integrated presentations of fire control, navigation, flight management, and symbolically annotated sensor information The integrated presentations provide situation displays based on a multitude of input data, making the pilot a systems manager B J

**A79-16234** # **MBB helicopters for the army (MBB - Hubschrauber fur das Heer)** K Pfleiderer (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 25 p In German

Twenty-five years of development of army helicopters at MBB from 1955 to 1980 is reviewed, with attention given to three phases (1) preliminary research (1955-1965), (2) preparatory design (1965-1975), and (3) realization (1975-1980) Particular consideration is given to the development of the BO family (BO 105 M, BO 102 M, and BO 46 M) of observation and communications helicopters and to the development of antitank attack helicopters In reference to the future, attention is given to joint German French and German-Japanese ventures in military helicopter development B J

**A79-16236** # **Important criteria for the definition and design of future helicopter powerplants (Wichtige Kriterien fur die Definition und Auslegung zukunftiger Hubschraubertriebwerke)** H Groenewald (Motoren- und Turbinen-Union Munchen GmbH, Munich, West Germany) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 34 p In German

The paper discusses weight/performance tradeoffs in the development of powerplants for future military helicopters, with reference to the influence of a number of design and cost factors Particular consideration is given to relationships between weight and cycles of operation, specific fuel consumption as a function of initial powerplant weight, the effects of one- and two-engine designs, typical characteristics of unscheduled engine removal rate, and factors in the selection of multiengine helicopters Definitions of turbine powerplant performance ratings are presented and recent helicopter engine design advances are outlined B J

**A79-16237** # **The Rolls-Royce Gem turboshaft engine for helicopters and its future developments** K R Davies (Rolls-Royce, Ltd , Aero Div , Leavesden, Herts , England) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 12 p

A general description of the Gem engine is presented and principal design features are discussed Particular consideration is given to modularity of design, installation features, condition

monitoring, engine and accessory replacement, and engine sortie pattern tests The Gem development history is reviewed with emphasis on experience with Gem-4 B J

**A79-16238 # Chief features of future helicopter avionics (Schwerpunkte zukunftiger Hubschrauber-Avionik)** G Peuker (Standard Elektrik Lorenz AG, Stuttgart, West Germany) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger Waffenschule, 1978 22 p In German

The paper reviews the design of sensor, display, and processor avionics for military (i e , transport, observation, and antitank) helicopters Particular consideration is given to avionics for the functions of navigation/flight control/communications, target recognition/target acquisition, and early warning An integrated systems concept for helicopter avionics is proposed based on a multichannel BUS system with digital processing This integrated concept entails lower production and operating costs and assures better pilot/helicopter interaction, increased system safety and failure tolerance, and increased flexibility B J

**A79-16239 # Development of the UH 60A helicopter** R Zincone (United Technologies Corp , Sikorsky Aircraft Div , Stratford, Conn ) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 16 p

The major elements of the advanced technology utilized in the UH 60A include (1) a composite titanium spar highly twisted rotor blade with advanced airfoils and swept tip, (2) a forged titanium hub elastometric main rotor, (3) a canted bearingless graphite tail rotor, (4) a self-tuned bifilar vibration absorber, (5) a modularized transmission system, (6) a digital automatic flight control system, (7) an automatically programmed stabilizer, and (8) the broad use of composite materials in the airframe The UH 60A is also designed to provide improved crashworthiness and ballistic survivability B J

**A79-16240 # Presentation of thermal or residual-light TV images on head-up displays for night or all-weather operations (Darstellung von Warme-bzw Restlicht-TV-Rasterbildern auf einem head-up display als Nacht-bzw Schlechtwettersehhilfe)** W Becker (Teldix GmbH, Heidelberg, West Germany) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger Waffenschule, 1978 6 p In German

The paper describes the operating modes of a head-up display system for a military helicopter designed for night and all-weather operations Particular attention is given to the integration of electrooptical sensors (i e , the TV camera and the IR camera) with the HUD Block diagrams illustrating the implementation of head up displays in avionic systems are presented B J

**A79-16241 # The Lynx hingeless rotor system and flight characteristics** A H Vincent (Westland Helicopters, Ltd , Yeovil, Somerset, England) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 13 p

The design process which has led to the Lynx hingeless rotor system is briefly described The principal design requirement was to develop a rotor system which was simpler and hence easier to maintain and more reliable than an equivalent articulated rotor The system has been shown to be completely free from all forms of mechanical and aeroelastic instability, and all the dynamic components have fatigue lives of at least 2500 hours In addition, the handling qualities conferred on the Lynx by virtue of the hingeless design of the rotor are highly desirable for NOE requirements B J

**A79-16242 # Lynx reliability and maintainability design and military service experience** E Roadnight (Westland Helicopters, Ltd , Yeovil, Somerset, England) In International Helicopter Forum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Proceedings Buckeburg, West Germany, Heeresflieger-Waffenschule, 1978 27 p

The specification for the two basic Lynx variants requires that, as a design aim, the helicopter have mission reliabilities of 96% for the Army variant and 95 5% for the more complex Navy variant, both to be achieved over a mission length of 1 5 hours This paper discusses this requirement for Lynx design in terms of aircraft handling, modifications, arming, role change, and bay servicing Designing to a maintainability target and designing to a reliability target are discussed separately and attention is given to aspects of proving B J

**A79 16243 # Improvement of safety for helicopter crews (Verbesserung der Sicherheit fur Hubschrauberbesatzungen)** R Scholz (Heeresflieger Waffenschule, Buckeburg, West Germany) *Internationales Hubschrauberforum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Paper* 36 p In German

A comparative evaluation shows that the flight safety of double-engine helicopters is improved over that of single-engine helicopters Army helicopter safety is reviewed with reference to ballistic hit survivability, agility, resistance to destruction, and crew ejection after being hit Flight safety in relation to helicopter noise and pilot error is also considered B J

**A79-16244 # Trends in helicopter rotor head design** A Cassier and J C Sieffer (Societe Nationale Industrielle Aerospatiale, Paris, France) *Internationales Hubschrauberforum, 12th, Buckeburg, West Germany, May 8, 9, 1978, Paper* 24 p

In the present paper, the various existing rotor head concepts are reviewed in an attempt to determine the effect of their aerodynamic and dynamic characteristics on helicopter performance The analysis leads to the conclusion that an ideal solution that would suit all modes of helicopter operation does not exist In view of this, the role of the designer is to seek the best tradeoffs V P

**A79-16372 Calculation of supersonic flow past wings with consideration of tangential discontinuities shed from the edges within the scope of a model using a system of Euler equations** A N Minailos *(Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Jan -Feb 1978, p 78-89 ) *Fluid Dynamics,* vol 13, no 1, Sept 1978, p 57-66 14 refs Translation

**A79-16431 # CITS - Tomorrow's test system today** K Derbyshire (Rockwell International Corp , Los Angeles, Calif ) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif , April 3 7, 1978, Proceedings Washington, D C , National Security Industrial Association, 1978, p 112 114

The Central Integrated Test System (CITS), developed for the B-1 aircraft, allows the B-1 to meet the requirements of self sufficiency and flight hours to maintenance of an advanced aircraft CITS continuously monitors all aircraft subsystems in flight and on the ground, and performs fault isolation to the LRU level Maintenance is accomplished through the use of CITS-supplied failure data and system operation is verified through the use of CITS active ground tests B J

**A79-16432 # Shop test success is a function of the airborne system design** G R England (General Dynamics Corp , Fort Worth, Tex ) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif , April 3-7, 1978, Proceedings Washington, D C , National Security Industrial Association, 1978, p 115-117

Without an effective organizational level capability in avionics testing, the effectiveness of the intermediate shop is largely negated

In an effort to remedy this problem, the following elements - considered essential in achieving a good organizational level fault detection and isolation capability have been introduced into the F-16 avionics (1) management emphasis, (2) mature equipments for good supportability and good performance, (3) a system partitioned for maintenance with simple interfaces, (4) secondary fault reporting capability within subsystems, (5) simplified fault detection and isolation mechanization, (6) early testing of fault detection and isolation capability, (7) comprehensive and unambiguous fault reporting, (8) adequate procedures for the aircrew and maintenance personnel, and (9) compatible support equipment B J

**A79-16436** # **Digital integrated test system improves testability** C D Brown (Lear Siegler, Inc, Grand Rapids, Mich) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif, April 3 7, 1978, Proceedings Washington, D C, National Security Industrial Association, 1978, p 133-135 Contract No F33615 75-C 1275

Advancements in the sophistication of aircraft avionics require similar advancements in test capability to eliminate the need for very highly skilled maintenance personnel, to increase confidence in mission success, and to reduce test hardware requirements When avionics subsystems and processors communicate on a multiplex data bus the integrated test system software performs preflight, inflight, and postflight tests to detect and diagnose system faults with high confidence at low cost (Author)

**A79-16439** # **Adjustment diagnostics for gas turbine engine controls** D C Thoman (Bendix Corp, Energy Controls Div, South Bend, Ind) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif, April 3 7, 1978, Proceedings Washington, D C, National Security Industrial Association, 1978, p 162 164

Adjustment diagnostics as applied to gas turbine engine control calibration is described The procedure embodies a mathematical model of the hydromechanical control system as well as a logic model for the test operator decision function It brings a high speed digital computer to the service of test personnel for the adjustment process, eliminating much of the repetitive testing associated with manual calibration For an automated test system application, adjustment diagnostics can provide significant reductions in test time with very little additional system costs The ease of calibration allows relatively inexperienced test personnel to achieve high levels of productivity with minimal training (Author)

**A79-16440** # **TF 41 condition monitoring system effectiveness study** L R DeMott (General Motors Corp, Detroit Diesel Allison Div, Indianapolis, Ind) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif, April 3 7, 1978, Proceedings Washington, D C, National Security Industrial Association, 1978, p 190 192 Navy supported research

The purpose of the Condition Monitoring System Effectiveness Study (CMSES) was to determine effectiveness versus cost relationships for several system configurations adapted to the TF41 A 2 engine for the Navy A7E attack aircraft A total of nine systems were evaluated for effectiveness from both a maintenance action and flight safety standpoint. This paper discusses the systems studied, the methodology utilized, and the results of the study B J

**A79-16441** # **Status of the FT9 engine condition monitor system /ECM/** H J Selfors (United Technologies Corp, Pratt and Whitney Aircraft Group, Hartford, Conn) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif, April 3-7, 1978, Proceedings Washington, D C, National Security Industrial Association, 1978, p 193-195

This report gives the current status of the NAVSEA development program on the FT9 Marine Gas Turbine Engine and the Engine Condition Monitor Emphasis is placed on events during the 5000 hour endurance test and their detectability by the ECM Hardware and software development problems as well as actual experience of the ECM with the engine are discussed Planned future evaluations of the system, including at-sea testing, are outlined (Author)

**A79-16442** # **LM2500 condition and performance monitoring system** R J E Dyson and E F Beeler (General Electric Co, Aircraft Engine Group, Loveland, Ohio) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif, April 3 7, 1978, Proceedings Washington, D C, National Security Industrial Association, 1978, p 196, 197 Navy-supported research

The original and the redesigned LM2500 condition and performance monitoring systems, which consist of sensors, cables, data acquisition unit, data processing unit, power supply, and battery, are described The redesigned system is being connected to a single engine (although it has the capability of monitoring four engines) and will be evaluated over a period of one year While the original design incorporated 40 sensors, the new design, a simplification for shipboard use, utilizes only 14 sensors, all of which are external to the engine and none of which require engine rework The goal of the monitoring system is to provide an indication of gas generation health without component fault isolation M L

**A79-16443** # **The challenge of new technology for avionics testing** P R Owens (USAF, Systems Command, Andrews AFB, Md) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif, April 3-7, 1978, Proceedings Washington, D C, National Security Industrial Association, 1978, p 201 203

Existing U S Air Force avionics technology, avionics test methods, and maintenance methods are briefly reviewed The electron-device technology that is being developed is discussed and related to problems and opportunities in test equipment and methodology Attention is given to various types of electrooptical equipment, microwave devices, and microelectronics systems These include forward-looking IR technology, fiber optics, integrated optical circuits, lasers and associated equipment, vacuum tubes, FETs, diodes, power combiners, millimeter-wave devices, SAW devices, magnetostatic surface-wave devices, large-scale integration, and microprocessors The need for better test methodologies that mesh with computer-aided design is emphasized F G M

**A79-16446** # **Operator and technician tasks for the heads-up display test set and versatile avionics shop test /VAST/** P E Van Hemel (U S Navy, Naval Training Equipment Center, Orlando, Fla) In Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology, Management, Acquisition Support, San Diego, Calif, April 3 7, 1978, Proceedings Washington, D C, National Security Industrial Association, 1978, p 392-394

Tasks performed by operators and technicians for two sets of automatic test equipment (ATE) are described and compared One set is the AN/AVM-11 (V), which is a test set for the USN A7-E Heads up Display Set, while the second set is the AN/USM 247 (V), the Versatile Avionics Shop Test (VAST) It is found that most of the tasks are common to the two sets and to ATE in general Nevertheless, it is suggested that some tasks, in particular tasks involving analysis of test program sets, might differ from traditional tasks It is thought the number of such tasks might increase in future generations of ATE M L

**A79-16494** # **Positive tail loads for minimum induced drag of subsonic aircraft** E V Laitone (California, University, Berkeley, Calif) *Journal of Aircraft*, vol 15, Dec 1978, p 837-842 10 refs

By applying Prandtl's relation for the induced drag of a biplane to typical wing-tail combinations, it can be shown that the minimum

induced drag occurs with a positive tail upload This fact has been overlooked because the reduction in the total induced drag by a tail download was overestimated by using the total downwash of the wing on the tail, while neglecting the downwash produced on the wing by the tail It is proved that, regardless of the relative size of the tail, the downwash produced by a tail download increases the induced drag of the wing so as to cancel the additional 'tail thrust,' and keep the mutually induced drag of a wing-tail combination the same as that induced upon the tail alone when it is in the wing's Trefftz-plane At any finite tail length the bound circulation vortex of the wing produces a downwash that increases the induced drag of a tail upload However, the circulation vortex system of the tail upload produces an upwash on the wing that results in a 'wing thrust' component that cancels the increased drag on the tail so that the total induced drag is a minimum with a positive tail load In order to facilitate the calculation of the mutually induced drag of typical wing-tail combinations, an explicit relation is derived for the limiting case of a small-span tail at any distance above or below a large-span wing. (Author)

**A79-16495 * #** **Comparative study between two different active flutter suppression systems** E Nissim (Technion - Israel Institute of Technology, Haifa, Israel) *Journal of Aircraft*, vol 15, Dec 1978, p 843 848 8 refs Grant No NsG 7072

An activated leading-edge (LE) tailing edge (TE) control system is applied to a drone aircraft with the objective of enabling the drone to fly subsonically at dynamic pressures which are 44% above the open loop flutter dynamic pressure The control synthesis approach is based on the aerodynamic energy concept and it incorporates recent developments in this area A comparison is made between the performance of the activated LE-TE control system and the performance of a TE control system, analyzed in a previous work The results obtained indicate that although all the control systems achieve the flutter suppression objectives, the TE control system appears to be somewhat superior to the LE-TE control system, in this specific application This superiority is manifested through reduced values of control surface activity over a wide range of flight conditions (Author)

**A79-16512** **Applications of DS composites in aircraft gas turbines** M Rabinovitch, T Khan, J-F Stohr, J M Hauser, and H Bibring (ONERA, Châtillon-sous-Bagneux, Hauts de Seine, France) In Advances in composite materials London, Applied Science Publishers, Ltd , 1978, p 289-317 18 refs

Two directionally cast (DC) composite 'families' for high temperature turbine blade applications are considered the 'Cotac' family developed at ONERA and the gamma/gamma prime delta-Ni-Ni3Al-Ni3Nb family developed at Pratt and Whitney The mechanical properties of these materials as compared to those of currently used superalloys are described It is shown that these materials offer a net gain in high-temperature creep strength as compared to present day superalloys Examination of their response to thermal cycling points to composites relatively insensitive to thermal cycling damage They exhibit an acceptable ductility and a good impact resistance Fatigue toughness is much better than that of superalloys Corrosion and oxidation behavior is equivalent to that of superalloys However, since both materials are intended for operation at higher temperatures, the coatings should be improved and matched to DS composites S D

**A79-16514** **Composite materials in helicopters** P Bellavita (Costruzioni Aeronautiche Giovani Agusta S p A , Gallarate, Italy) In Advances in composite materials London, Applied Science Publishers, Ltd , 1978, p 357-381

The reasons for choosing helicopter rotor blades as one of the first components to be made from composite materials are discussed, along with the main advantages of using composite materials to meet the required tasks The development of high-modulus fibers (graphite, boron, Kevlar) during the past ten years has been a substantial improvement over glass in a number of areas Criteria used in helicopter technology for optimized selection between metals and composites are described Attention is given to the best combination between fiber and matrix in composites A brief description of the advantages and disadvantages arising when choosing different fabrication techniques are outlined In addition, typical helicopter components, besides the blades, made from composite materials are mentioned, including the main rotor hub, the tail boom, the transmission gearbox, and the torque transmission S D

**A79-16537** **A new L-band MLS/DME with high accuracy** E O Kirner (Bendix Corp , Avionics Div , Fort Lauderdale, Fla ) In SOUTHEASTCON '78, Proceedings of the Southeast Region 3 Conference, Atlanta, Ga , April 10-12, 1978 Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1978, p 121-123 FAA-sponsored research

The solid state DME airborne and ground equipment designed for high accuracy MLS requirements is described The L-band DME is an active system whose principle is based on elapsed propagation time measurements between the transmission of an interrogation pulse pair and the reception of a corresponding reply from a ground-based transponder Modern LSI technology and microprocessors are used for filtering and processing the digital data In addition to range and range rate, terrain-independent height is computed from distance and MLS elevation and displayed in the cockpit B J

**A79-16550** **Infrared resolution target system** B H Colt (USAF, Eglin AFB, Fla ) In SOUTHEASTCON '78, Proceedings of the Southeast Region 3 Conference, Atlanta, Ga , April 10 12, 1978 Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1978, p 402 404

The paper describes a USAF-developed mobile infrared resolution target system and its use in testing airborne 8-14 micron IR imaging systems The computer controlled system arranges warm/cool patterns on a 26-foot-square panel mounted on a 40-foot flatbed trailer The target contains 28 separately controlled 1 foot by 7-foot heated panels or elements arranged in two rows of 14 elements each (a 6-foot wide border surrounds these elements) The target is also used for testing airborne lasers and laser seeker systems M L

**A79-16552** **Radar applications of millimeter waves** S L Johnston, Sr (U S Army, Missile Research and Development Command, Redstone Arsenal, Ala ) In SOUTHEASTCON '78, Proceedings of the Southeast Region 3 Conference, Atlanta, Ga , April 10-12, 1978 Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1978, p 409-412 27 refs

Civilian and military applications of Ka band and millimeter wave radars are discussed The tendency to use higher frequencies for special applications is discussed, and applications which utilize advantages of millimeter waves are considered Most of the millimeter band applications surveyed are shorter range applications than are Ka band applications and there is a greater diversity of military applications among the millimeter band applications M L

**A79-16576** **Reliability and quality in aeronautics and astronautics, Meeting, Hanover, West Germany, April 27, 28, 1978, Reports (Zuverlassigkeit und Qualitat in der Luft- und Raumfahrt, Tagung, Hanover, West Germany, April 27, 28, 1978, Vortrage)** Meeting sponsored by the Verein Deutscher Ingenieure *VDI-Berichte*, no 307, 1978 93 p In German

Methods of analyzing, predicting, and improving reliability of products during design, production, and service are described Topics studied include reliability requirements and large-scale projects, monitoring quality of guided missiles after delivery to user, design review in joint projects, error tree analysis for improving design, controlling software reliability during software design, systematic and statistical methods of obtaining reliability parameters of programs, and Airbus reliability record P T H

**A79-16583** **Reliability of aircraft structures (Die Zuverlassigkeit von Flugzeugstrukturen)** H -J Zocher *(Verein Deutscher Ingenieure, Tagung uber Zuverlassigkeit und Qualitat in der Luft- und Raumfahrt, Hanover, West Germany, Apr 27, 28, 1978) VDI-Berichte,* no 307, 1978, p 33-42 24 refs In German

The paper sets forth constructive, computational, and experimental methods which, in conjunction with goal-specific maintenance and inspection measures, ensure operational safety and reliability of modern aircraft The discussion covers the damage tolerant structure concept, computational methods of establishing the life of a structure, determination of residual life after crack phase sets in, and a methodology for laying out total-structure fatigue tests P T H

**A79-16584** **Inertial technology and reliability (Inertialtechnik und Zuverlassigkeit)** E Handrich *(Verein Deutscher Ingenieure, Tagung uber Zuverlassigkeit und Qualitat in der Luft- und Raumfahrt, Hanover, West Germany, Apr 27, 28, 1978) VDI-Berichte,* no 307, 1978, p 43-48 In German

The paper describes the measurement techniques involved in some of the main forms of inertial navigation Attention is given to conventional gyrosystems, consisting in general of two 2-axis gyros and a single-axis accelerometer, and strapdown systems The failure modes of conventional gyros and dry gyros are identified P T H

**A79-16585** **Application of the fault tree in fault testing and design improvement (Uber die Anwendung des Fehlerbaumes bei der Fehlersuche und Konstruktionsverbesserung)** K Broschk and H Keller *(Verein Deutscher Ingenieure, Tagung uber Zuverlassigkeit und Qualitat in der Luft- und Raumfahrt, Hanover, West Germany, Apr 27, 28, 1978) VDI-Berichte,* no 307, 1978, p 49-54 5 refs In German

The method of fault tree analysis is illustrated on some simple systems such as a switchable electric circuit and an aircraft spoiler system The technique of fault finding by means of the fault tree is described An example of how fault tree analysis helps improve a design by revealing critical events with high probability that can be replaced by ones with lower probability is discussed P T H

**A79-16591** **Reliability improvement program (Zuverlassigkeitsverbesserungsprogramm)** C -P Klauser *(Verein Deutscher Ingenieure, Tagung uber Zuverlassigkeit und Qualitat in der Luft- und Raumfahrt, Hanover, West Germany, Apr 27, 28, 1978) VDI-Berichte,* no 307, 1978, p 83-86 In German

A program for improving the reliability of products is proposed which is aimed at equipment in the late development and testing stage or even during service The program is oriented along the current knowledge of the failure behavior of electronic components and their possibilities for modification by changing their operating and environmental loads Weak spots in a device are detected and located experimentally P T H

**A79-16618** * # **Laser aircraft propulsion** A Hertzberg and K Sun (Washington, University, Seattle, Wash ) In Radiation energy conversion in space, Conference, 3rd, Moffett Field, Calif , January 26-28, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 243 263 23 refs Grant No NGL-49-002 044

The concept of using a high energy continuous wave laser beam from a power satellite in geosynchronous orbit to power a commercial air transport during cruise, i e , a laser powered airplane, is examined These studies indicate that a laser powered airplane is a nearly fuelless and pollution-free flight transportation system which is cost competitive with the fuel conservative air transport of the future This laser flight system involves the integration of a conventional aircraft with a laser power satellite and a set of laser driven turbofans, all of which can be fabricated with existing or projected technology The dominant cost of the laser-powered flight transportation system is the cost of the power satellite (Author)

**A79-16619** # **Laser-powered aircraft and rocket systems with laser energy relay units** W S Jones (Lockheed Missiles and Space Co , Inc , Palo Alto, Calif ) In Radiation energy conversion in space, Conference, 3rd, Moffett Field, Calif , January 26-28, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 264-270 8 refs

The transmission of laser energy between the upper atmosphere or low earth orbit and synchronous equatorial (syn eq) orbit requires very large transmitter apertures to maintain a reasonable size receiver on laser powered aircraft or rockets The laser beam spot size at the receiver is a function of the diffraction-limited beam spread, the optical quality of the beam as it exits the laser, beam jitter, the wavefront error as the beam leaves the transmitting aperture, the range of transmission, and atmospheric effects in the case of laser powered aircraft The use of space-based Laser Energy Relay Units enhances laser powered aircraft and orbit-to-orbit rocket systems by reducing the size requirements of the transmitter aperture on the laser and the receivers on the aircraft and rockets by effectively reducing the range of transmission, i e , the range of transmission between the relay and aircraft or rocket is much less than from the laser to the aircraft or rocket Relays also reduce pointing and tracking requirements and they permit transmission of energy to aircraft and rockets that are not within the line-of-sight of the laser transmitter (Author)

**A79-16679** **Friction and wear of carbon-graphite materials for high-energy brakes** R C Bill (U S Army, Propulsion Laboratory, Cleveland, Ohio) In International Conference on Solid Lubrication, 2nd, Denver, Colo , August 15-18, 1978, Proceedings Park Ridge, Ill , American Society of Lubrication Engineers, 1978, p 268-280 11 refs

An experimental study was conducted on a caliper-type brake simulation apparatus to determine the friction and wear behavior of a series of carbon-graphite materials in a high-energy friction situation against a steel disk material and a carbon-graphite disk material The materials selected were intended to show the effects of concentration of carbon binder, changes in filler constituents, addition of an oxidation inhibitor, and the presence of a graphite cloth reinforcement on high-energy friction and wear Optical microscopy and SEM were used to identify wear mechanisms Increased wear resulted from reductions in binder level, additions of B4C and additions of SiC respectively The graphite-cloth-reinforced composite exhibited the lowest wear rate of all the carbon-graphite formulations against the steel disk material However, heavy wear and erratic friction resulted for graphite-cloth-reinforced composite sliding against a disk of similar composition SiC additions up to 15% to graphite-based material are desirable for improved oxidation resistance S D

**A79-16781** # **Parametric method for diagnosing the state of aircraft engines on the basis of limited information (Parametricheskii metod diagnostiki sostoianii aviatsionnykh dvigatelei po ogranichennoi informatsii)** A M Akhmedzianov, A P Tunakov, Kh S Gumerov, Iu D Degtiarev, and E I Morkovnikova *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 12-18 In Russian

A diagnostics algorithm is proposed for studying the state of the air fuel duct on the basis of limited information on the thermogasdynamic parameters The mathematical model of the engine is used as the transmitting diagnostic channel V P

**A79-16787** # **Experimental study of the gasdynamic characteristics of a nozzle guide vane row with air ejection onto the vane surface (Eksperimental'noe issledovanie gazodinamicheskikh kharakteristik soplovoi reshetki s vyduvom vozdukha na poverkhnost' lopatok)** O N Emin, I I Kutysh, and P I Shvartsman *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 46 53 8 refs In Russian

**A79-16789** # **Determination of the deflection angle of a jet impinging on a deflector with an end plate (Opredelenie ugla povorota strui natekaiushchei na kovsh s kozyr'kom)** L M Kotliar, S G Margulis, and E D Nesterov *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 58-62 6 refs In Russian

The flow inside a symmetrical target-type thrust reverser is analyzed under the assumption of an imponderable fluid The reverser ejection angle is calculated by Chaplygin's method of singular points A technique for determining the ejection angle as a function of the deflector parameters is proposed V P

**A79-16792** # **Influence of the pitch/chord ratio of a subsonic cascade of turbine blades (O vliianii otnositel'nogo shaga v dozvukovoi reshetke turbiny)** V G Nesterenko and G L Podvidz *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 75-80 8 refs In Russian

The influence of varying the pitch/chord ratio from 0 8 to 1 5 on the performance of a subsonic cascade of turbine airfoils is analyzed for large flow angles The flow of an ideal compressible fluid in the aperture between two blades is calculated and compared with the experiment Two types of separated flow are identified which may arise at pitch/chord ratios above the critical value V P

**A79-16794** # **Analytical designing of complex systems II (Analiticheskoe proektirovanie slozhnykh sistem II)** T K Sirazetdinov and A I Bogomolov *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 85-91 16 refs In Russian

In the present paper, the problem of analytically designing complex systems is formulated and is placed in proper perspective with respect to the general process of systems design An approach, based on control theory, is proposed to the analytical designing of complex systems The application of this approach is demonstrated by examples V P

**A79 16802** # **Analytical representation of turbine characteristics in a form convenient for computer-aided computation of gas-turbine engine parameters (Analiticheskoe predstavlenie kharakteristik turbin v vide, udobnom dlia rascheta parametrov GTD na EVM)** V I Bakulev, K A Malinovskii, and V S Iakushev *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 142 144 In Russian

The method proposed in the present paper makes it possible to describe the performance of a turbine in terms of two functions that can be well approximated by polynomials This provides a simple means of determining the operational field of the turbine and calculating gas-turbine engine parameters V P

**A79-16806** # **Operation of long-service-life gas-turbine engines as a function of the technical state (K voprosu ekspluatatsii GTD bol'shogo resursa po tekhnicheskomu sostoianiiu)** A A Mukhin, A A Kovalev, and A A Kornoukhov *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 153 156 In Russian

The service life of a gas turbine engine depends primarily on the endurance of the turbine blades, which depends on the gasdynamic and centrifugal stresses, the nonuniformity of the temperature field, the gas temperature, the atmospheric conditions, and seasonal effects In the present paper, the endurance of first stage blades prepared from ZhS6KP alloy is analyzed for the actual operating conditions of a modern long range airliner involving temperature variations ranging from -55 to +45 C and pressure variations from 725 to 775 torr Methods of evaluating the technical state of turbine blades are discussed V P

**A79-16807** # **Application of the method of alternating directions to the numerical analysis of the thermal states of a bladed turbine disk (Primenenie metoda peremennykh napravlenii pri chislennom issledovanii temperaturnykh sostoianii diska turbiny s lopatkami)** A M Poliakov, V S Petrovskii, and V I Krichakin *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 156-160 In Russian

In the present paper, an economical scheme of integrating over two space variables is applied to the solution of the unsteady-state thermal problem for an axial-flow turbine disk with blades having elongated roots The problem is reduced to a system of two-dimensional unsteady-state heat equations for the blades and disk The disk profile is defined by means of arbitrary functions which delimit the contour of the lateral surfaces By means of linear-fractional transformation, the curvilinear contour of the disk is transformed into a rectangle The problem then can be solved for coupled rectangular blade and disk regions connected by the boundary conditions V P

**A79-16808** # **Characteristics of a turbojet bypass engine with afterburner during oxygen supply to the afterburner (Kharakteristiki TRDDF pri podache kisloroda v forsazhnuiu kameru)** B D Fishbein *Aviatsionnaia Tekhnika,* vol 21, no 3, 1978, p 160-164 6 refs In Russian

In the present paper, the thermodynamic effectiveness of thrust augmentation by supplying oxygen to the afterburner of a turbojet bypass engine is calculated for various modes of flight The thermodynamic characteristics of air, air-oxygen mixtures, and combustion products of kerosene in air and in air-oxygen mixtures are tabulated It is shown that for minimum excess oxidant (air oxygen) ratio, an oxygen supply of 10 to 20 percent of the rate of airflow results in thrust augmentation by factors of 1 18 to 1 2 at M = 0, and by factors of 1 8 to 2 2 at M = 3 2 The total specific fuel consumption increases by factors of 2 4 to 4 4 at M = 0, and by factors of 2 0 to 2 8 at M = 3 2 V P

**A79-16976** # **Why the ALAT chose the 'Gazelle/Hot' /SA-342 M/ as antitank helicopter (Pourquoi l'A L A T a choisi la 'Gazelle/Hot' /SA-342 M/ comme helicoptere anti-chars)** *Air et Cosmos* vol 16, Dec 2, 1978, p 25 29 In French

The paper describes some of the characteristics of the SA-342 M, a 1 5 2 5 ton antitank helicopter, equipped with Hot missiles The geometry and technical definition of the SA 342 M are derived from the Gazelle 341, while the subassembly configuration and character istics are drawn from the Alouette III/SS 11 The aircraft is equipped with a single Astazou XIV engine modified to permit tactical flight at 1800 kg The inside equipment features three radio units (VHF AM, UHF, and VHF/FM), an IFF, Doppler navigation system for forward navigation, digital display radio compass for backward navigation, two artificial horizons, a high precision radio altimeter, and an automatic pilot The helicopter is capable of 2 5 hours of flight without refueling P T H

# STAR ENTRIES

**N79-11996#** European Space Agency Paris (France)
**LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NO 1978-1**
Aug 1978 125 p refs Transl into ENGLISH of La Rech Aerospatiale, Bull Bimestriel (Paris) no 1978-1, Jan -Feb 1978 p 1-52 Original French report available from ONERA Paris FF 36
(ESA-TT-491) Avail NTIS HC A06/MF A01

The following topics are discussed a new method for correcting two-dimensional wall interference, contribution of high-voltage electron microscopy to the study and improvement of refractory composites dynamic stability of a two-blade rotor, an experimental study of the dynamic forces acting on an airfoil, and creep prediction of directionally solidified Cotac_74 composite

**N79-11999** European Space Agency, Paris (France)
**DYNAMIC STABILITY OF A TWO-BLADE ROTOR**
Cam Thuy Tran (ONERA) *In its* La Rech Aerospatiale Bi-monthly Bull No 1978-1 (ESA-TT-491) Aug 1978 p 63-96 refs Transl into ENGLISH from La Rech Aerospatiale Bull Bimestriel (Paris) no 1978-1, Jan -Feb 1978 p 25-40 Original report in FRENCH previously announced as A78-32037 Supported in part by the Aeronautical Test Centre Toulouse

HC A06/MF A01

An analytical method is presented in which Lagrange equations are simplified to a system of ordinary differential equations with constant coefficients in an evaluation of the dynamic stability of a two blade rotor at high tip speeds with negligible aerodynamic disturbance Attention is given to the parameterization of the divergence velocity It is noted that the coupling of the degrees of freedom of the rotating arm and of the flexibility degrees of freedom of the stand may provoke divergence Author (ESA)

**N79-12000** European Space Agency Paris (France)
**AN EXPERIMENTAL STUDY OF THE DYNAMIC FORCES ACTING ON AN AEROFOIL**
Edmond Szechenyi (ONERA) *In its* La Rech Aerospatiale, Bi-monthly Bull No 1978-1 (ESA-TT-491) Aug 1978 p 97-112 refs Transl into ENGLISH from La Rech Aerospatiale, Bull Bimestriel (Paris) no 1978-1 Jan -Feb 1978 p 41-47 Presented at the 3d European Forum on Rotating Airfoils and Dyn Lift Aix-en-Provence France, 7-9 Sep 1977 Original report in FRENCH previously announced as A77-50995

HC A06/MF A01

Aerodynamic instabilities and random excitations occurring on two-dimensional airfoils at nonzero incidence angles and subsonic flow speeds were studied experimentally with particular attention devoted to stall flutter For the purpose of investigating separately the buffeting phenomenon and the risk of aeroelastic instability at high incidence the random pressure field was measured on clamped airfoils while unsteady aerodynamic coefficients which reveal the possibility of instabilities for certain torsion modes were obtained from vibrating airfoils Shadowgraph flow visualizations were filmed at high speeds and show the flow conditions for random excitation (buffeting) and for two types of aerodynamic instability one of which is stall flutter the other being a shock instability on the lower surface of the airfoil Author (ESA)

**N79-12002#** Michigan State Univ , East Lansing
**CORROSION TRACKING AND PREDICTION FOR C-141A AIRCRAFT MAINTENANCE SCHEDULING Final Report, Sep 1975 - Oct. 1977**
Robert Summitt Wright-Patterson AFB Ohio AFML Apr 1978 242 p refs
(Contract F33615-75-C-5284)
(AD-A057984, AFML-TR-78-29) Avail NTIS HC A11/MF A01 CSCL 01/3

Analysis of corrosion maintenance and utilization histories of C-141A aircraft has shown that these records can be used to develop a corrosion-prediction model Exploitation of such a model could result in better efficiency in the use of aircraft maintenance facilities, and manpower since corrosion maintenance could be scheduled at the optimum time with respect to repairability need and available resources The USAF Maintenance Data Collection System does not generate sufficiently accurate and consistent records however, to base a prediction model on existing data A number of changes to the System would improve the quality of the data sufficiently so that an effective model could be developed Potential cost benefits are far larger than those needed to effect the changes hence the recommended changes should be implemented at an early date Author (GRA)

**N79-12003#** Naval Air Engineering Center, Lakehurst N J Ground Support Equipment Dept
**NON-DESTRUCTIVE EVALUATION SYSTEMS FOR THE NAVAL AVIATION MAINTENANCE ENVIRONMENT TECHNOLOGY ASSESSMENT Final Report, Aug 1972 - Sep 1977**
R Cahall 5 Jul 1978 129 p refs
(AD-A058146 NAEC-GSED-120) Avail NTIS HC A07/MF A01 CSCL 01/5

Under NAVAIRSYSCOM direction NAEC-GSED conducted an investigation and analysis of the field of non-destructive evaluation as it relates to the Naval aviation community This report finalizes that task Areas of discussion include general description of what NDE is and why it is practiced how inspection requirements are established and suggested methods for improvement assessment of the positive impact expanded utilization of NDE could provide discussion of present and future field inspection requirements technology base assessment/ projection and recommended research program options
Author (GRA)

**N79-12010** Virginia Polytechnic Inst and State Univ , Blacksburg
**NONLINEAR STEADY AND UNSTEADY AERODYNAMICS OF WINGS AND WING-BODY-COMBINATIONS Ph D Thesis**
Essam Hamed Atta 1978 129 p
Avail Univ Microfilms Order No 7822718

A modified vortex lattice method was developed to solve the nonlinear, three dimensional, unsteady incompressible flow over delta wings Symmetric motions (pitching, heaving) and asymmetric motions (roll, yaw) were considered Then the method was generalized to treat the nonlinear three dimensional steady flow for bodies and wing body combinations Numerical examples included a variety of shapes and comparison with existing experimental data and other numerical methods over a wide range of angle of attack showed good agreement For bodies alone the results deteriorated downstream of the separation region while for wing-body combinations, the agreement with the experimental data was good, as long as the body separation effect was not large Dissert Abstr

**N79-12015*#** National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
**EFFECT OF ROTOR TIP CLEARANCE AND CONFIGURATION ON OVERALL PERFORMANCE OF A 12 77-CENTIMETER TIP DIAMETER AXIAL-FLOW TURBINE**
Jeffrey E Haas (Army Aviation Research and Development Command) and Milton G Kofskey 1978 14 p refs To be presented at 24th Ann Intern Conf San Diego, Calif 11-15 Mar 1979, sponsored by Am Soc of Mech Engr
(NASA-TM-79025 E-9181-1 AVRADCOM-TR-78-54) Avail NTIS HC A02/MF A01 CSCL 01A

The rotor tip clearance was obtained by use of a recess in the casing above the rotor blades and also by use of a reduced blade height For the recessed casing configuration the optimum rotor blade height was found to be the one where the rotor tip diameter was equal to the stator tip diameter The tip clearance loss associated with this optimum recessed casing configuration was less than that for the reduced blade height configuration G G

**N79-12016*#** National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

**WIND TUNNEL TESTS OF A BLADE SUBJECTED TO MIDCHORD TORSIONAL OSCILLATION AT HIGH SUBSONIC STALL FLUTTER CONDITIONS**

D R Boldman and A E Buggele Oct 1978 33 p refs
(NASA-TM-78998 E-9782) Avail NTIS HC A03/MF A01 CSCL 01A

A mechanical drive system for oscillating blades in a wind tunnel at frequencies up to 767 hertz and amplitudes of + or - 1 2 deg is described High-speed motion pictures of schlieren images of the flow over a double-circular arc blade oscillating in harmonic motion about the midchord revealed extensive shock patterns at a nominal free stream Mach number of 0 7 a mean angle of attack of 4 deg, and reduced frequency of about 0 7 A phase lag resulting from the slow response of the flow to the motion of the blade increased with increasing reduced frequency This phase lag based on the difference between the time the blade attained its maximum angle of attack and the time required for the normal shock to reach its extreme downstream position was nominally 100 deg at the above conditions Author

**N79-12017*#** National Aeronautics and Space Administration Washington D C

**FLOW-FIELD IN A VORTEX WITH BREAKDOWN ABOVE SHARP EDGED DELTA WINGS**

Yoshio Hayashi and Teruomi Nakaya Nov 1978 117 p refs Transl into ENGLISH of ' Breakdown o Tomonau Sankaku-Yoku Zen-En Hakuri Uzu no Nagareba , Rept NAL-TR-423 Natl Aerospace Lab Tokyo Aug 1975 46 p Translation was announced as N76-21157 Transl by Kanner (Leo) Associates Redwood City Calif
(Contract NASw-3199)
(NASA-TM-75339 NAL-TR-423) Avail NTIS HC A06/MF A01 CSCL 01A

The behavior of vortex-flow accompanied with breakdown, formed above sharp-edged delta wings, was studied experimentally as well as theoretically Emphasis is placed particularly on the criterion for the breakdown at sufficiently large Reynolds numbers G G

**N79-12018*#** National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

**EXPERIMENTAL INVESTIGATION OF WING FIN CONFIGURATIONS FOR ALLEVIATION OF VORTEX WAKES OF AIRCRAFT**

Vernon J Rossow Nov 1978 38 p refs
(NASA-TM-78520 A-7593) Avail NTIS HC A03/MF A01 CSCL 01A

A variety of fin configurations were tested on a model of the Boeing B747 in 40 by 80 foot wind tunnels The test results confirmed that a reduction in wake rolling moment was brought about by the vortex shed by the fins so that a wide range of designs can be used to achieve wake alleviation It was also found that the reduction in wake-induced rolling moments was especially sensitive to the location of the smaller fins on the wing and that the penalties in lift and drag can probably be made negligible by proper fin design J A M

**N79-12019*#** National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif

**COMPREHENSIVE HELICOPTER ANALYSIS A STATE OF THE ART REVIEW**

Wayne Johnson Nov 1978 18 p refs Prepared in cooperation with Army Aviation Research and Development Command Moffett Field, Calif
(NASA-TM-78539, AVRADCOM-78-56(AM), A-7661) Avail NTIS HC A02/MF A01 CSCL 01A

An assessment of the status of helicopter theory and analysis is presented The technology level embodied in available design tools (computer programs) is examined, considering the problem areas of performance, loads and vibration, handling qualities and simulation and aeroelastic stability The effectiveness of the present analyses is discussed The characteristics of the technology in the analyses are reviewed, including the aerodynamics technology induced velocity and wake geometry dynamics technology, and machine limitations Author

**N79-12020*#** National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

**AN APPROACH TO OPTIMUM SUBSONIC INLET DESIGN**

R W Luidens N O Stockman, and J H Diedrich 1978 14 p refs Proposed for presentation at the 24th Ann Intern Gas Turbine Conf and 1st Solar Energy Conf 11-15 Mar 1979, sponsored by Am Soc of Mech Engr
(NASA-TM-79051 E-9860) Avail NTIS HC A02/MF A01 CSCL 01A

Inlet operating requirements are compared with estimated inlet separation characteristics to identify the most critical inlet operating condition This critical condition is taken to be the design point and is defined by the values of inlet mass flow, free-stream velocity and inlet angle of attack Optimum flow distributions on the inlet surface were determined to be a high, flat top Mach number distribution on the inlet lip to turn the flow quickly into the inlet and a flat bottom skin-friction distribution on the diffuser wall to diffuse the flow rapidly and efficiently to the velocity required at the fan face These optimum distributions are then modified to achieve other desirable flow characteristics Example applications are given G G

**N79-12021*#** National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif

**CANARD-BODY-TAIL MISSILE TEST AT ANGLES OF ATTACK TO 50 DEG IN THE AMES 11-FOOT TRANSONIC WIND TUNNEL**

Clyde Q Allen Richard G Schwind (Nielsen Eng and Res , Inc Mountain View, Calif ), and Gerald N Malcolm Sep 1978 1217 p refs
(NASA-TM-78441) Avail NTIS HC A99/MF A01 CSCL 01A

Blunted ogive cylinder missile models with a length-to-diameter ratio of 10 4 were tested at transonic speeds and large angles of attack in an 11 foot transonic wind tunnel The configurations are body body with tail panels, body with canards and body with canards and tails Forces and moments from the entire model and each of the eight fins were measured over the pitch range of 20 deg to 50 deg and roll angles of 0 deg to 45 deg and canard deflection angles between 0 deg and 15 deg The Reynolds number ranged from 3 9 x 10 to the 6th power per meter Large side forces and yawing moments were observed for some of the test cases involving a symmetric geometry B B

**N79-12022#** McDonnell-Douglas Research Labs , St Louis, Mo

**COMPRESSIBLE VISCOUS FLOWFIELDS AND AIRFRAME FORCES INDUCED BY TWO-DIMENSIONAL LIFT JETS IN GROUND EFFECT Interim Technical Report, 1 Feb 1977 - 28 Feb 1978**

W W Bower 1 Mar 1978 111 p refs
(Contract N00014-76-C-0494 RR0141184)
(AD-A059231 ONR-CR-215-246-2) Avail NTIS HC A06/MF A01 CSCL 20/4

The interaction of the lift jets and the ground is an important consideration with regard to the design of VTOL aircraft A key element of this ground effect problem is turbulent jet entrainment, which causes otherwise static air to be set into motion and leads to aerodynamic loads on airframe surfaces To gain a better understanding of this phenomenon, a theoretical analysis of two-dimensional (planar) compressible turbulent jet impingement flowfields has been undertaken Lift jets emanating from

flat and curved surfaces in close ground effect have been modeled using the compressible Reynolds equations in combination with a one-equation turbulence model Distributions of the flow properties are computed as functions of the Reynolds, Prandtl and Froude numbers and height of the jet exit plane above ground Author (GRA)

**N79-12023#** Dayton Univ Ohio
**THE AEROELASTIC ANALYSIS OF A TWO-DIMENSIONAL AIRFOIL IN TRANSONIC FLOW Final Report, Jul. 1977 - Sep 1977**
Donald P Rizzeta Dec 1977 56 p refs
(Contract F33615-76-C-3146, AF Proj 2307)
(AD-A057505, AFFDL-TR-77-126) Avail NTIS HC A04/MF A01 CSCL 20/4

A procedure is developed for the aeroelastic analysis of a two-dimensional airfoil in transonic flow The fluid is assumed to be described by the unsteady low frequency small disturbance transonic potential equation for which a fully time implicit method of integration (LTRAN2) exists Structural equations of motion for a three degree of freedom NACA 64A010 airfoil are integrated in time simultaneously with the unsteady potential equation *using representative values of the structural parameters The* method is shown to be both stable and accurate, and the time response for several choices of initial conditions and reduced freestream density is presented Oscillations with either increasing or decreasing amplitudes are found to result solely from the choice of initial conditions Author (GRA)

**N79-12027#** Grumman Aerospace Corp Bethpage, N Y
**AN AUTOMATED PROCEDURE FOR COMPUTING THE THREE-DIMENSIONAL TRANSONIC FLOW OVER WING-BODY COMBINATIONS, INCLUDING VISCOUS EFFECTS VOLUME 2 PROGRAM USER'S MANUAL AND CODE DESCRIPTION Final Report, May 1975 - Oct 1977**
William H Mason, Donald Mackenzie Mark Stern William F Ballhaus, and Juanita Frick Wright-Patterson AFB Ohio AFFDL Feb 1978 476 p refs
(Contract F33615-75-C-3073 AF Proj 1476)
(AD-A054998, AFFDL-TR-77-122-Vol-2) Avail NTIS HC A21/MF A01 CSCL 01A

This volume provides the detailed information required to use the program described in Volume 1 of this report This includes a description of the input data set, and the output results A complete sample case is included in order to illustrate the use of the program The full details of the method are described in Volume 1 however a brief description of the method is provided The program is a numerical method that predicts the detailed pressure distribution on wing-body combinations at transonic Mach numbers less than one and integrates the pressures to obtain aircraft force and moment data The code has been developed with the intent of providing the user with an easy to use and reliable tool The basic inviscid prediction method is the modified transonic small disturbance theory program In order to provide accurate surface pressure predictions on the wing several additional features of the typical transonic flowfield have been incorporated These consist of the viscous displacement effect local strong viscous interaction at the shock wave foot and at the trailing edge (including an approximate treatment of local shallow separations) and finally the interaction effect of the fuselage GRA

**N79-12028#** Advisory Group for Aerospace Research and Development, Paris (France)
**TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON UNSTEADY AERODYNAMICS**
H Bergh (Natl Aerospace Lab Amsterdam) Oct 1978 8 p Symp held at Ottawa 26-28 Sep 1977
(AGARD-AR-128 ISBN-92-835-1300-2) Avail NTIS HC A02/MF A01

The proceedings of a symposium on unsteady aerodynamics are presented and the following topics are discussed (1) unsteady subsonic and supersonic flow (2) unsteady transonic flow, (3) unsteady nonseparated and separated boundary layers (4) viscous-inviscid interactions, dynamic stall and (5) unsteady flows associated with rotors cascades, and turbomachinery B B

**N79-12029*#** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
**CONFERENCE ON FIRE RESISTANT MATERIALS (FIREMEN) A COMPILATION OF PRESENTATIONS AND PAPERS**
Demetrius A Kourtides ed Oct 1978 508 p refs Conf held at Ames Res Center Moffett Field, Calif 13-14 Apr 1978
(NASA-TM-78523 A-7605) Avail NTIS HC A23/MF A01 CSCL 13L

The proceedings of the NASA Fire Resistant Materials Engineering (FIREMEN) Program held at Ames Research Center on April, 13 14 1978 are reported The purpose of the conference was to discuss the results of NASA in the field of aircraft fire safety and fire resistant materials The program components include the following (1) large-scale testing (2) fire toxicology, (3) polymeric materials and (4) bibliography related and/or generated from the program

**N79-12030*#** National Aeronautics and Space Administration Lyndon B Johnson Space Center Houston, Tex
**THE 737 AIRCRAFT FLAMMABILITY TESTING**
Richard W Bricker *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 14-38

Avail NTIS HC A23/MF A01 CSCL 13L

The FAA requested approximately 20 component and full-scale tests in a 737 fuselage to provide validation data or indicate changes that need to be made to a fire math model (Dayton Aircraft Cabin Fire Model) developed for the FAA Some preliminary tests were conducted to evaluate the adequacy of planned instrumentation The objectives of the program were met in that it was verified that propagation of a fire could be determined from the sequential response of thermocouples located on a test specimen(such as a seat) and continuous weighing of *the specimen during the test was accomplished Two different* techniques for measuring smoke density were found to be comparable Author

**N79-12031*#** Douglas Aircraft Co, Inc Long Beach, Calif
**DOUGLAS AIRCRAFT CABIN FIRE TESTS**
David Klinck *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 39-68

Avail NTIS HC A23/MF A01 CSCL 13L

Program objectives are outlined as follows (1) examine the thermal and environmental characteristics of three types of fuels burned in two quantities contained within a metal lavatory, (2) determine the hazard experienced in opening the door of a lavatory containing a developed fire (3) select the most severe source fuel for use in a baseline test and (4) evaluate the effect of the most severe source upon a lavatory constructed of contemporary materials All test were conducted in the Douglas Cabin Fire Simulator Author

**N79-12032*#** Boeing Commercial Airplane Co Seattle Wash
**FIRE TESTING IN THE BOEING 707 CABIN SECTION**
Everett A Tustin *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 69-96

Avail NTIS HC A23/MF A01 CSCL 13L

The goal of a FIREMEN funded contract is the definition of a laboratory test method ranking airplane interior materials by probable performance in post-crash and in-flight fires A major task is the relation of laboratory results to full scale data A large test facility for testing materials to the thermal threat of fuel fed and interior fires was developed with quartz lamps and a propane burner in a twenty foot fuselage section A method was developed to analyze full scale data for the apparent heat, smoke and toxicant release rates of the material tested Author

**N79-12033*#** Boeing Commercial Airplane Co Seattle, Wash
**DEVELOPMENT OF LIGHTWEIGHT, FIRE-RETARDANT, LOW SMOKE, HIGH STRENGTH, THERMALLY STABLE AIRCRAFT FLOOR PANELING**

Roy A Anderson and Richard T Karch *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 97-124

Avail NTIS HC A23/MF A01 CSCL 13L

Boeing's participation in a NASA funded program (FIREMEN) to develop materials for use as floor panels possessing flammability, smoke and toxicity characteristics superior to current materials is outlined The objectives of the program are to develop an aircraft floor paneling suitable for high traffic areas e g aisle or galley and to install and certify the panel in a commercial aircraft for service evaluation Author

**N79-12034*#** Lockheed-California Co , Burbank
**THERMOPLASTICS FOR AIRCRAFT INTERIORS**
Bernard Silverman *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 125-134

Avail NTIS HC A23/MF A01 CSCL 13L

The goal for this contract is the development of processes and techniques for molding thermally stable fire retardant low smoke emitting polymeric materials Outlined in this presentation are (1) the typical molding types (2) a program schedule, (3) physical properties of molding types with the test methods to be used, (4) general properties of injection molding materials and (5) preliminary materials selection G Y

**N79-12040*#** National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
**OVERVIEW OF FIREMEN PROGRAM AT AMES RESEARCH CENTER**
Demetrius A Kourtides *In its* Conf on Fire Resistant Mater Oct 1978 p 247-282

Avail NTIS HC A23/MF A01 CSCL 13L

The Ames Firemen Program is described The key elements of the program include (1) the development and evaluation of aircraft interior composite panels, (2) the thermochemical and flammability characterization of thermoset and thermoplastic resins, and (3) the evolution of fire resist aircraft seat components The first two elements are presented S E S

**N79-12041*#** Boeing Commercial Airplane Co Seattle, Wash
**DEVELOPMENT OF AIRCRAFT LAVATORY COMPARTMENTS WITH IMPROVED FIRE RESISTANCE CHARACTERISTICS**
Roy A Anderson and Gerald A Johnson *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 283-362

Avail NTIS HC A23/MF A01 CSCL 13L

The Boeing's participation in a NASA-funded program (FIREMEN) included developing materials for use as lavatory wall panels sidewall panels and ceiling panels possessing flammability, smoke, and toxicity (FS&T) characteristics superior to current materials of construction is described A sandwich panel system is developed for improving FS&T characteristics and acceptable cost processing requirements aesthetic qualities abrasion resistance, strain resistance scuff resistance, and washability S E S

**N79-12042*#** Hughes Aircraft Co Culver City Calif
**PHOSPHORYLATED EPOXY ADHESIVES**
Norman Bilow *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 363-373

Avail NTIS HC A23/MF A01 CSCL 07C

Fire retardant adhesives for aircraft interiors are developed Monomers epoxy synthesis diamine synthesis, acrylic modified epoxy and phosphorylated amine epoxy blends are examined S E S

**N79-12043*#** Solar Turbines International San Diego Calif
**DEVELOPMENT OF FIRE-RESISTANT, LOW SMOKE GENERATING, THERMALLY STABLE END ITEMS FOR AIRCRAFT AND SPACECRAFT**
John Gagliani *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 375-418

Avail NTIS HC A23/MF A01 CSCL 01C

A new approach to the problem of flammability by the use of materials obtained from foamy polyimide resins is developed The ability of these materials to provide fire protection is demonstrated The development of processes for producing resilient cell foam for use in aircraft seating, thermal acoustical insulation, floor and wall panels coated glass fabrics, and molded hardware S E S

**N79-12044*#** Douglas Aircraft Co Inc Long Beach, Calif
**FIRE RESISTANT AIRCRAFT SEAT MATERIALS**
Edward L Trabold *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 421-432

Avail NTIS HC A23/MF A01 CSCL 01C

The establishment of a technical data base for individual seat materials in order to facilitate materials selections is reviewed The thermal response of multi-layer constructions representative of the basic functional layers of a typical future seat is examined These functional layers include (1) decorative fabric cover (2) slip sheet (topper) (3) fire blocking layer (4) cushion reinforcement, and (5) cushioning layer The implications for material selection for full-scale seats are discussed S E S

**N79-12045*#** Massachusetts Inst of Tech Cambridge
**FABRICS FOR FIRE RESISTANT PASSENGER SEATS IN AIRCRAFT**
Giuliana C Tesoro *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 433-456

Avail NTIS HC A23/MF A01 CSCL 11E

The essential elements of the problem and of approaches to improved fire resistance in aircraft seats are reviewed The performance requirements and availability of materials, delay in the ignition of upholstery fabric by a small source are considered a realistic objective Results of experimental studies on the thermal response of fabrics and fabric/foam combinations suggest significant conclusions regarding (1) the ignition behavior of a commercial 90/10 wool/nylon upholstery fabric relative to fabrics made from thermally stable polymers (2) the role of the foam backing (3) the behavior of seams These results coupled with data from other sources, also confirm the importance of materials' interactions in multicomponent assemblies, and the need for system testing prior to materials selection The use of an interlinear or thermal barrier between upholstery fabric and foam is a promising and viable approach to improved fire resistance of the seat assembly but experimental evaluation of specific combinations of materials or systems is an essential part of the selection process Author

**N79-12046*#** Jet Propulsion Lab , Calif Inst of Tech Pasadena
**ENCLOSURE FIRE MODELING**
Clifford D Coulbert *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 457-477 refs

(Contract NAS7-100)

Avail NTIS HC A23/MF A01 CSCL 13L

A fire characterization methodology is presented which for the first time provides a unified analysis framework for the integration of all fire tests data on a common basis Fire temperatures, smoke densities toxic gas concentrations and heat fluxes to material properties, enclosure geometry, and ventilation factors are provided in this fire characterization approach The fire characterization methodology was used to develop an enclosure fire hazards analysis procedure capable of predicting the probable course in fire prevention S E S

**N79-12047*#** Naval Ship Research and Development Center Annapolis, Md
**MODEL FIRE TESTS ON POLYPHOSPHAZENE RUBBER AND POLYVINYL CHLORIDE (PVC)/NITRILE RUBBER FOAMS**

William M Widenor *In* NASA Ames Res Center Conf on Fire Resistant Mater (FIREMEN) Oct 1978 p 479-491

Avail NTIS HC A23/MF A01 CSCL 07C

A video tape record of model room fire tests was shown, comparing polyphosphazene (P-N) rubber and polyvinyl chloride (PVC)/nitrile rubber closed-cell foams as interior finish thermal insulation under conditions directly translatable to an actual fire situation Flashover did not occur with the P-N foam and only moderate amounts of low density smoke were formed, whereas with the PVC/nitrile foam, flashover occurred quickly and large volumes of high density smoke were emitted The P-N foam was produced in a pilot plant under carefully controlled conditions The PVC/nitrile foam was a commercial product A major phase of the overall program involved fire tests on P-N open-cell foam cushioning Author

**N79-12048*#** Douglas Aircraft Co, Inc Long Beach, Calif
**STUDY TO DEVELOP IMPROVED FIRE RESISTANT AIRCRAFT PASSENGER SEAT MATERIALS, PHASE 2 Final Technical Report, 20 Sep 1977 - 30 Jun. 1978**
Fred E Duskin, William H Shook, Edward L Trabold, and Howard H Spieth [1978] 379 p refs
(Contract NAS2-9337)
(NASA-CR-152184) Avail NTIS HC A17/MF A01 CSCL 01C

Fire tests are reported of improved materials in multilayered combinations representative of cushion configurations Tests were conducted to determine their thermal, smoke, and fire resistance characteristics Additionally, a source fire consisting of one and one-half pounds of newspaper in a tented configuration was developed Finally a preliminary seat specification was written based upon materials data and general seat design criteria G G

**N79-12049#** Federal Aviation Administration, Washington, D C
**ENGINEERING AND DEVELOPMENT PROGRAM PLAN: AIRCRAFT SAFETY**
Jun 1978 40 p
(AD-A058546, FAA-ED-18-1A) Avail NTIS HC A03/MF A01 CSCL 01/3

The Aircraft Safety Program Engineering and Development Plan describes the objectives, the scope of work and the funding requirements to meet the Federal Aviation Administration's research need in aircraft safety for the 1978-85 period The plan covers work in fire safety, transport safety, and general aviation aircraft safety Author

**N79-12050#** Dayton Univ, Ohio Research Inst
**DAYTON AIRCRAFT CABIN FIRE MODEL VALIDATION, PHASE 1 Final Report, Jun 1976 - Nov. 1977**
Charles D MacArthur and John F Myers Mar 1978 141 p refs
(Contract DOT-FA74WA-3532)
(AD-A058547 UDRI-TR-78-44, FAA-RD-78-57) Avail NTIS HC A07/MF A01 CSCL 01/3

Refinements were made to the Dayton University aircraft fire mathematical model following a comparison to seven full-scale cabin mock up fire tests Changes include a generalization of the treatment of the cabin geometry to include of various widths, improved thermal radiation modeling computation of oxygen consumption, and a treatment of forced ventilation A laboratory testing program to acquire flammability, smoke and gas generation data on the furnishing materials of the full-scale test is described Based on the results of the comparisons sections of the mathematical model which require further refinement are identified and some appropriate refinements are suggested A R H

**N79-12051#** Aeronautical Systems Div, Wright-Patterson AFB, Ohio
**AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS ESCAPE, RESCUE AND SURVIVAL Annual Report, calendar year 1978**
Donald C Kittinger Apr 1978 20 p Supersedes ASD-TR-77-2
(AD-A058208, ASD-TR-78-21, ASD-TR-77-2) Avail NTIS HC A02/MF A01 CSCL 06/7

This report is a part of a compilation of formalized Technology Needs (TN) covering Equipment Subsystems as identified in the Aeronautical Systems Division They are based on development/operational experience systems studies and new concepts - all related to future system applications Their presentation is to serve a threefold purpose, i e (1) guidance for technology program, (2) proven developmental potential and (3) engineering data/requirements essential for technology use in systems The identified needs delineate progress desired in performance, control design flexibility, safety and cost Author (GRA)

**N79-12052#** Air Force Inst of Tech, Wright-Patterson AFB Ohio *School of Systems and Logistics*
**A STATISTICAL ANALYSIS OF SELECTED HUMAN FACTORS INVOLVED IN AVIATION SAFETY M S Thesis**
*James R Berry and Samuel L DeLoach Jun 1978 81 p refs*
(AD-A059284 AFIT-LSSR-6-78A) Avail NTIS HC A05/MF A01 CSCL 01/2

This report presents a review of the biorhythm theory and performs a statistical analysis on over 2400 aviation accidents obtained from the Army Aviation Safety Center, Fort Rucker, Alabama The analysis was performed to determine if there was a statistically significant relationship between aviation accident dates and biorhythm caution days The Binomial Goodness-of-Fit Test was applied against the data No significant relationship between the aviation accidents and biorhythm caution days was found Author (GRA)

**N79-12054*#** AVCON Aviation Consultants Boulder, Colo
**OPERATIONAL REQUIREMENTS FOR FLIGHT CONTROL AND NAVIGATION SYSTEMS FOR SHORT HAUL TRANSPORT AIRCRAFT**
John A Morrison May 1978 90 p
(Contract NAS2-9028)
(NASA-CR-152208) Avail NTIS HC A05/MF A01 CSCL 17G

To provide a background for evaluating advanced STOL systems concepts a number of short haul and STOL airline operations in the United States and one operation in Canada were studied A study of flight director operational procedures for an advanced STOL research airplane, the Augmented Wing Jet STOL Research Airplane, was conducted using the STOLAND simulation facility located at the Ames Changes to the advanced digital flight control system (STOLAND) installed in the Augmentor Wing Airplane are proposed to improve the mode sequencing to simplify pilot procedures and reduce pilot workload S B S

**N79-12055#** National Aviation Facilities Experimental Center, Atlantic City, N J
**AN ANALYSIS OF RADIO NAVIGATION SENSOR ACCURACIES ASSOCIATED WITH AREA NAVIGATION (RNAV) Final Report, Sep 1974 - Sep 1976**
Thomas V Logue Aug 1978 83 p
(FAA Proj 044-326-500)
(AD-A058544 FAA-NA-77-45, FAA-RD-78-85) Avail NTIS HC A05/MF A01 CSCL 17/7

Flight test data gathered during a series of RNAV flight tests are presented Radio navigation sensor errors and the resulting errors in position determination are emphasized that are inherent in area navigation operation in the terminal area Statistical data as well as distributions of the errors are presented Also included is a comparison of the Advisory Circular 90-45A tangent point table calculated from regression equations One standard deviation of 1 4 nautical miles for very high frequency omnidirectional radio range (VOR) and 0 11 nautical mile for distance measuring equipment (DME) were computed from the flight test data These statistics represent combined ground and airborne sensor errors G G

**N79-12056#** Federal Aviation Administration Washington D C ATC Systems Div
**ENGINEERING AND DEVELOPMENT PROGRAM PLAN CENTRAL FLOW CONTROL SYSTEM**
Aug 1978 98 p refs
(AD-A058549, FAA-ED-11-1A) Avail NTIS HC A05/MF A01 CSCL 17/7

The central flow control system is being developed as a centralized automated air traffic prediction management system It regulates the flow of traffic to an airport, allows for ground holding delays and minimizes airborne delays resulting in significant fuel savings and the smoothing of traffic flow to coincide with airport capacity B B

**N79-12057#** Draper (Charles Stark) Lab Inc Cambridge, Mass
**MULTIFUNCTION INERTIAL REFERENCE ASSEMBLY TECHNOLOGY (MIRAT) SIMULATION DEVELOPMENT, CONFIGURATION EVALUATION, AND TEST PLAN DEVELOPMENT Final Report, 1 Feb - 31 Dec. 1977**
Paul Motyka Roy Nurse and Kevin Daly Wright-Patterson AFB Ohio AFAL Mar 1978 105 p refs
(Contract F33615-77-C-1103)
(AD-A057324 R-1135, AFAL-TR-78-33) Avail NTIS HC A06/MF A01 CSCL 01/4

The significance of this research and development lies in the application of the developed simulation tools and techniques to the evaluation of potential Multifunction Inertial Reference Assembly (MIRA) sensor systems These systems use a minimum number of inertial sensors to provide the inertial-reference information necessary to meet the aircraft requirements for weapon delivery, flight control, navigation, fire control and flight safety This contract considers development of real-time operation and the addition of a navigation and attitude error-propagation algorithm Other models added to the simulation are two-degree-of-freedom gyros an air-data system an autopilot, and a transport vehicle Parametric studies and evaluations of potential MIRA configurations were conducted to support the definition of the long-term MIRA requirements, and to provide an independent evaluation of candidate configurations The philosophy and details of a test and development plan, specifically geared to MIRA systems, are also discussed GRA

**N79-12058#** Draper (Charles Stark) Lab , Inc Cambridge, Mass
**FUNCTIONAL REQUIREMENTS OF THE INTERFACE BETWEEN THE NAVSTAR GPS RECEIVER MODEL X AND THE ADVANCED INERTIAL REFERENCE SPHERE, VOLUME 2 Final Report**
Bernard A Kriegsman, William M Stonestreet, and Duncan B Cox Dec 1977 99 p refs
(Contract F04701-75-C-0212)
(AD-A057656, R-981-Vol-2 SAMSO-TR-77-120-Vol-2) Avail NTIS HC A05/MF A01 CSCL 17/7

The performance requirements for the GPS X-set impose difficult and conflicting design problems on the receiver To accurately track the incoming signals in a high-dynamics environment, a wide-bandwidth tracking loop is required with a high-order tracking network For best performance in the presence of noise, on the other hand, a narrow bandwidth tracking loop is desired Techniques for utilizing an Inertial Measurement Unit (IMU), such as the Advanced Inertial Reference Sphere (AIRS) to aid the receiver tracking loops are studied The IMU can provide accurate information on translational accelerations and orientation changes experienced by the receiver By properly using the IMU data, the receiver bandwidth can be reduced without increasing the dynamics-induced tracking error The end result is an improvement in performance in noisy or jamming situations GRA

**N79-12059#** Draper (Charles Stark) Lab Inc , Cambridge, Mass
**FEASIBILITY STUDY OF GPS-INERTIAL NAVIGATION FOR HELICOPTERS AND STUDY OF ADVANCED GPS SIGNAL PROCESSING TECHNIQUES, VOLUME 3 Final Report, Nov 1976 - Mar 1978**
Duncan B Cox Jr Bernard A Kriegsman William M Stonestreet, John Kishel and Luigi V Calicchia Mar 1978 198 p refs
(Contract F04701-75-C-0212)
(AD-A057659 R-981-Vol-3 SAMSO-TR-77-120-Vol-3) Avail NTIS HC A09/MF A01 CSCL 17/7

This report is presented in two parts Part 1 presents the results of a feasibility study of a low-cost integrated GPS-inertial (strapdown) navigation system for Army attack helicopters The conclusion is reached that a GPS-Doppler navigation system can more easily attain the cost and performance goals It was also concluded that an integrated GPS-Doppler-inertial system might be very attractive if it could be used for providing attitude and heading reference data as well as navigation data There would be a cost savings association with avoiding the need for the usual attitude and heading reference systems Moreover the integrated GPS-Doppler-inertial system would have excellent performance in the presence of aircraft dynamics and jamming Part 2 presents the results of a study of advanced GPS signal processing techniques Covered in the study are data aiding, comparison of phase-locked loops with Costas loops, variable predetection bandwidths in code-tracking loops code loop dithering aided tracking, variable tracking bandwidths, and effective gains of detectors in the presence of noise The results are from computer simulation and theoretical analysis Author (GRA)

**N79-12060** Engineering Sciences Data Unit London (England)
**LOCAL BUCKLING AND CRIPPLING OF I, Z AND CHANNEL SECTION STRUTS**
Jul 1978 6 p
(ESDU-78020, ISBN-0-85679-222-5) For information on availability of series, sub-series and other individual data items write NTIS Attn ESDU Springfield, Va 22161 HC $146 50

All proportions of unlipped I Z and channel section struts of any length with flange to web thickness ratios from 0 5 to 4 0 manufactured from homogeneous isotropic materials are analyzed Author

**N79-12061*** National Aeronautics and Space Administration Hugh L Dryden Flight Research Center Edwards Calif
**FREE WING ASSEMBLY FOR AN AIRCRAFT Patent**
Chester H Wolowicz inventor (to NASA) Issued 7 Nov 1978 9 p Filed 8 Sep 1977 Supersedes N77-31135 (15 - 22 p 2894)
(NASA-Case-FRC-10092-1 US-Patent-4 124 180
US-Patent-Appl-SN-831634, US-Patent-Class-244-82
US-Patent-Class-244-48 US-Patent-Class-244-90R) Avail US Patent and Trademark Office CSCL 01C

A free wing is attached to a fuselage of an aircraft in a manner such that the wing is free to pivot about a spanwise axis forward of its aerodynamic center The wing is angularly displaced about the axis by aerodynamic pitching moments, resulting from lift and is trimmed through a use of a trimmable free stabilizer comprising a floating canard mounted on a strut rigidly connected to the wing and projected forward from it Official Gazette of the U S Patent and Trademark Office

**N79-12062*#** National Aeronautics and Space Administration, Washington D C
**TECHNICAL PROBLEMS ENCOUNTERED WITH THE LALA-1 FLYING LABORATORY**
J Swidzinski Nov 1978 27 p Transl into ENGLISH from Tech Lotnicza i Astronautyczna (Poland) v 28, 1973 p 8-14 Original language document was announced as A73-26823 Transl by Kanner (Leo) Associates Redwood City Calif
(Contract NASw-3199)
(NASA-TM-75585) Avail NTIS HC A03/MF A01 CSCL 01C

A description is given of structural design changes necessitated by the conversion of the An-2R agricultural support aircraft into a flying test bed to be used in feasibility studies evaluating jet engines in agricultural support aircraft The entire rear of the fuselage was radically modified to permit mounting of the Al-25 jet engine directly behind the trailing edge of the upper wing The standard piston engine was retained to permit comparison between the two types of power plants in typical agricultural support operations Author

**N79-12063*#** National Aeronautics and Space Administration, Washington D C
**THE M-15-AIRCRAFT (SAMOLOT M-15)**
R Leliecki Nov 1978 11 p Transl into ENGLISH from Biuletyn Informacyjny (Poland) v 9 Nov - Dec 1972 p 5-6 Original language document was announced as A73-28026 Transl by Kanner (Leo) Associates Redwood City, Calif
(Contract NASw-3199)
(NASA-TM-75586) Avail NTIS HC A02/MF A01 CSCL 01C

The M-15 is an all-metal semimonocoque, twin-tail-boom sesquiplane aircraft designed exclusively for agricultural support

operations involving slow low-level flight It is powered by a single AI-25 bypass turbojet engine used in the Yak-40 aircraft Tanks for spraying chemicals are mounted between the lower and upper wings Dimensions weights and performance data are tabulated Author

**N79-12064*#** Kansas Univ Center for Research Inc Lawrence
**INVESTIGATION OF THE CROSS-SHIP COMPARISON MONITORING METHOD OF FAILURE DETECTION IN THE HiMAT RPRV**
James A Wolf Dec 1978 99 p refs
(Grant NSG-4012)
(NASA-CR-144879) Avail NTIS HC A05/MF A01 CSCL 01C

The Highly maneuverable aircraft technology (HiMAT) remotely piloted research vehicle (RPRV) uses cross-ship comparison monitoring of the actuator RAM positions to detect a failure in the aileron canard and elevator control surface servosystems Some possible sources of nuisance trips for this failure detection technique are analyzed A FORTRAN model of the simplex servosystems and the failure detection technique were utilized to provide a convenient means of changing parameters and introducing system noise The sensitivity of the technique to differences between servosystems and operating conditions was determined The cross-ship comparison monitoring method presently appears to be marginal in its capability to detect an actual failure and to withstand nuisance trips G G

**N79-12065*#** Boeing Co Wichita Kans
**B-52B-008/DTV (DROP TEST VEHICLE) CONFIGURATION 1 (WITH AND WITHOUT FINS) FLIGHT TEST RESULTS - CAPTIVE FLIGHT AND DROP TEST MISSIONS**
Delmar A Quade 20 Oct 1978 21 p refs
(Contract NAS8-31805)
(NASA-CR-150855 D3-11220-3) Avail NTIS HC A02/MF A01 CSCL 01C

The B-52B-008 drop test consisted of one takeoff roll to 60 KCAS, two captive flights to accomplish limited safety of flight flutter and structural demonstration testing and seven drop test flights Of the seven drop test missions one flight was aborted due to the failure of the hook mechanism to release the drop test vehicle (DTV) but the other six flights successfully dropped the DTV Author

**N79-12066*#** General Dynamics/Fort Worth Tex
**AERODYNAMIC CHARACTERISTICS OF FOREBODY AND NOSE STRAKES BASED ON F-16 WIND TUNNEL TEST EXPERIENCE VOLUME 2 DATA BASE Final Report, 1 Sep 1977 - 30 Sep 1978**
C W Smith and I C Bhateley Sep 1978 757 p
(Contract NAS1-15006)
(NASA-CR-158922) Avail NTIS HC A99/MF A01 CSCL 01C

The YF-16 and F-16 developmental wind tunnel test program was reviewed and all force data pertinent to the design of forebody and nose strakes extracted A complete set of these data is presented without analysis J M S

**N79-12067#** Army Aviation Systems Command St Louis Mo
**PROCEEDINGS OF THE TECHNICAL CONFERENCE ON THE EFFECTS OF HELICOPTER DOWNWASH ON FREE PROJECTILES**
Nov 1975 305 p refs Conf held at Bridgetown Mo 12-14 Aug 1975
(AD-A058123) Avail NTIS HC A14/MF A01 CSCL 19/4

*Partial contents* The Perturbed Flow Environment about Helicopters and its Effect on Free Rockets Some Practical Aspects of Rotor Wake Effects on Rocket Accuracy AH-1G Helicopter Field Flow Survey Total QE Component Variation under Hover Downwash Conditions for Long Range Targets (3-6km) The Effects of Rotor-Wake on Rockets Rotor-Wake Induced Flow along Helicopter Rocket Trajectories, Analysis of Effects of Calculated Downwash Distribution on Flight Performance of the 2 75 inch Rocket, Measurement of Helicopter Air Data Using Surveilling Pitot Static Pressure Probes, Correlation of Actual Induced Flow with Theory for Bell NUH-1M Helicopter Rotor Operating in Level Flight Review of LORAS Characteristics, General Requirements for Omni Directional Low Range Airspeed System LORAS Displays Ultrasonic Wind Vector Sensor Application of Remote Wind Sensors Effects of Airflow on Jettison of Multi-Track Launchers from Helicopters, and VA 210-220 Series Low Speed Indicator 1 to 150k and Air Speed/Directional Sensor 2 Axis VT1003 GRA

**N79-12068#** Naval Ship Research and Development Center, Bethesda Md Aviation and Surface Effects Dept
**AN EXAMINATION OF THE FACTORS AFFECTING THE THRUST REQUIREMENTS AND THE HOVER AND SHORT TAKEOFF PERFORMANCE OF SEVERAL JET V/STOL FIGHTER CONCEPTS**
Richard E Kuhn May 1978 69 p refs
(zf61412001)
(AD-A058128 DTNSRDC/ASED-78/08) Avail NTIS HC A04/MF A01 CSCL 01/3

A study of five jet vertical takeoff and landing fighter concepts was made considering height and attitude control ground effect ingestion losses control bleed effects, installation losses component weights and short takeoff performance A fixed gross weight of 35 000 pounds was assumed for each of the following concepts studied Lift Plus Lift/Cruise Lift/Cruise Plus Remote Burner Lift/Cruise (bleed air for control), Vertical Attitude Takeoff and Landing and Tilt Wing Since total mission performance was not included in the study no conclusion as to the best concept is made, but rather some of the mission/concept tradeoffs are presented Author (GRA)

**N79-12069#** ARO Inc Arnold Air Force Station Tenn
**CORRELATION OF EXPERIMENTAL AND THEORETICAL STEADY-STATE SPINNING MOTION FOR A CURRENT FIGHTER AIRPLANE USING ROTATION-BALANCE AERODYNAMIC DATA Final Report, 1 Jul 1976 - 30 Jun. 1977**
T F Langham AEDC Jul 1978 64 p refs
(AD-A058142 AEDC-TR-77-126) Avail NTIS HC A04/MF A01 CSCL 01/2

An analytical study has been conducted to determine the usefulness of rotation-balance aerodynamic data in calculating the steady-state spin motion of a current fighter aircraft configuration The analysis utilizes a nonlinear six-degree-of-freedom digital computer program to generate time histories of airplane spinning motion Three aerodynamic data models were formulated and used in the spin analysis The first model represents the conventional use of static and forced-oscillation data the second model uses the static and forced-oscillation data but restricts the forced-oscillation data to that component of the total angular rate that is oscillatory, and the third model incorporates rotation-balance data from model 2 and restricts the rotation-balance data to that component of the total angular rate that is steady state The results indicate a significantly different motion resulting from the three aerodynamic data models when compared to each other and to full-scale flight test steady-state spin motions The motions produced by the rotation-balance aerodynamic model more closely simulate the motions exhibited during the flight tests Author (GRA)

**N79-12070#** Bendix Corp North Hollywood, Calif Electrodynamics Div
**DEVELOPMENT OF A HIGH TEMPERATURE ROTARY ACTUATOR FOR AIRCRAFT HYDRAULIC SYSTEMS Final Report, Apr 1972 - Dec 1977**
R K Vanausdal May 1978 204 p refs
(Contract F33615-72-C-1187, AF Proj 3145)
(AD-A057931, AFAPL-TR-78-26) Avail NTIS HC A10/MF A01 CSCL 13/7

This report describes the development program for a high temperature hydraulic rotary actuator based on the DYNAVECTOR concept Included are illustrated results based on replies by six airframe companies to a Bendix survey that determined the projected 1975-80 horizontal tail and rudder actuator stiffness requirements for fighter/attack aircraft, as well as the critical design conditions relative to Mach number and altitude Also reported are the results for the 800 F ambient testing of three different shaft seals designs (created for the program) that are presented in terms of leakage versus time temperature and

pressure Actuator test results -- with and without the epicyclic gear transmission -- and analyses included in the report reveal that the limitation imposed by the particular transmission disengagement concept used for load decoupling (actuator redundancy application) prohibitively detracts from the performance of the actuator for analog control Author (GRA)

**N79-12071#** Lockheed-Georgia Co Marietta
**C-130 WELDBONDED FUSELAGE PANEL FLIGHT EVALUATION PROGRAM Final Report, 15 Oct. 1974 - 15 Dec. 1977**
J A Kizer Dec 1977 33 p refs
(Contract F33615-75-C-3010 AF Proj 2401)
(AD-A057928 LG77ER0218 AFFDL-TR-77-138) Avail NTIS HC A03/MF A01 CSCL 01/3

The objective of this program was to conduct an in-service evaluation of the C-130 weldbonded fuselage panel A total of seven nondestructive inspections were conducted during which all of the inspections included visual and ultrasonic inspection of the weldbonded joints Three of the seven inspections included radiographic inspections of a portion of the spot-welds in the weldbonded fuselage panel All inspections were conducted coincident with aircraft isochronal inspections The fuselage panel performed in an operational environment with a minimum of problems as the only defects detected were some small breaks in the interior paint finish over the skin-to-ring frame sealed fillets These small breaks were detected with the aid of a pocket magnifier as they could not have been detected by the naked eye These small paint finish breaks were repaired and recurrence or additional breaks were not detected in the two subsequent inspections The Air Force will continue conducting periodic inspections on the weldbonded fuselage panel GRA

**N79-12072#** Air Force Flight Dynamics Lab Wright-Patterson AFB Ohio
**A MINIMUM WEIGHT ANALYSIS OF AEROSPACE VEHICLE RECOVERY SYSTEMS Final Report, Nov 1974 - Jun 1975**
Stephen R Mehaffie May 1977 127 p refs
(AF Proj 1964)
(AD-A058025 AFFDL-TR-77-26) Avail NTIS HC A07/MF A01 CSCL 01/3

This report presents an algorithm for determining the minimum weight of an aerospace vehicle recovery system The weight of the recovery system composed of parachute and impact attenuation subsystems is examined for the effects of advanced technologies including Kevlar materials and advanced attenuators The vehicle description for input to the algorithm consisting of recovered weight, maximum acceleration, and characteristic length allows the algorithm to be applied to a large variety of aerospace vehicles and payloads The algorithm provides optimized component weights and operating characteristics Author (GRA)

**N79-12073#** Bihrle Applied Research Inc Jericho, N Y
**DESIGN CHARTS AND BOUNDARIES FOR IDENTIFYING DEPARTURE RESISTANT FIGHTER CONFIGURATIONS Final Report**
William Bihrle Jr and Billy Barnhart Jul 1978 76 p refs
(Contract N62269-77-C-0106 WF41421201)
(AD-A058043 NADC-76154-30) Avail NTIS HC A05/MF A01 CSCL 01/3

A study is reported which generated design charts and developed associated boundaries for identifying departure and uncoordinated roll-reversal flight characteristics as a function of three aerodynamic parameters This information should be valuable for specification, design and evaluation purposes The investigation utilized a large angle, six-degree-of-freedom digital computer program to simulate the motions of a fighter performing a severe air combat maneuver for different combinations of rolling and yawing coefficient and lateral control characteristics Author (GRA)

**N79-12074#** Army Research and Technology Labs Fort Eustis Va
**TESTS TO DETERMINE THE ULLAGE EXPLOSION TOLERANCE OF HELICOPTER FUEL TANKS**
Charles M Pedriani Jun 1978 42 p refs
(DA Proj 1F2-62209-AH7600)
(AD-A058188 USARTL-TN-29) Avail NTIS HC A03/MF A01 CSCL 13/4

Twenty-one ballistic tests were conducted on fuel tanks similar to those on US Army helicopters to determine their ability to withstand pressures generated during an ullage explosion The tanks were filled with known JP-4/air gas mixtures and impacted with caliber 30 M1 incendiary projectiles at approximately 2000 feet per second The pressure rise was measured with transducers and the tank reponse was recorded with high-speed photography The results indicated that noncrashworthy bladder tanks in honeycomb structure have an overpressure threshold of about 20 psig while crashworthy tanks in Z-bar reinforced aluminum structure can tolerate explosive pressure to about 60 psig The results can be useful in the design of optimum ullage protection schemes for the armor piercing incendiary (API) combat threat Author (GRA)

**N79-12075#** Boeing Aerospace Co Seattle Wash
**INTEGRATION OF AIR CUSHION LANDING SYSTEM TECHNOLOGY INTO THE JINDIVIK REMOTELY PILOTED VEHICLE Final Report, Apr 1975 - Jan 1977**
A J P Lloyd and V K Rajpaul Mar 1978 308 p refs
(Contract F33615-75-C-3088, AF Proj 2402)
(AD-A058004 AFFDL-TR-77-21) Avail NTIS HC A14/MF A01 CSCL 01/3

Studies have been conducted on an Air Cushion Landing System for the Australian Jindivik target drone aircraft Analyses are presented of the airflow and yaw thruster control systems and the vehicle stability with a deployed recovery trunk is assessed The vehicle touchdown and slideout on a recovery trunk are presented and the design of an improved retention/release system is shown Author (GRA)

**N79-12076#** Naval Air Test Center, Patuxent River Md
**TESTING THE F-18 AT THE US NAVAL AIR TEST CENTER**
Joe L Dunn 14 Aug 1978 16 p
(AD-A058036 NATC-TM-78-5-SA) Avail NTIS HC A02/MF A01 CSCL 01/3

The U S Navy is procuring the F-18 as a replacement for the F-4 and A-7 aircraft starting in 1983 The F-18 design advancements include control-by-wire digital flight control system, cockpit designed for one man operability, state-of-the-art avionics integration by software/multiplex techniques and a high use of composite materials The unique aspect of the F-18 Full Scale Development program is that it will be principal sited at the Naval Air Test Center Patuxent River Maryland Author (GRA)

**N79-12077#** Mission Research Corp , Albuquerque N Mex
**AIRCRAFT CABLE PARAMETER STUDY Final Report**
H M Fowles L D Scott A K Agrawal, and K M Lee Oct 1977 175 p
(Contract F29601-76-C-0091)
(AD-A058267, AD-E200096, AMRC-R-92) Avail NTIS HC A08/MF A01 CSCL 17/2

This report describes experimental and analytical results obtained from a study of the transmission line properties of multiconductor cables commonly found on aircraft A method for the complete characterization of multiconductor transmission lines in inhomogeneous media is presented and verified experimentally Bulk transmission line properties of bundles containing up to 20 closely spaced wires were measured for cases of a bundle near a flat ground plane near a corner and in conduit The results are compared with single wire handbook formulas and discussed Perturbations on transmission lines caused by bulkheads cable clamps and the ribbed interior of aircraft were measured for several cases It was found that the perturbations could be treated as lumped capacitive loads on an otherwise uniform line Cable parameter measurements conducted on board an EC-135 aircraft are presented and discussed GRA

**N79-12078#** Army Aviation Engineering Flight Activity Edwards AFB Calif
**AH-1G HELICOPTER MAIN ROTOR FLOW SURVEY Final Report, May 1975 - Oct. 1975**

Barclay H Boirun Edward E Bailes, Robert P Jefferis James A Arnold and Joseph C Meiss Apr 1978 92 p refs
(AD-A057443 USAAEFA-74-02) Avail NTIS HC A05/MF A01 CSCL 20/4

The Army requirement to fire unguided missiles from attack helicopters in hover and low-speed flight conditions has generated a need to accurately predict the rotor flow environment through which the missile must travel Representative flight test airflow data is presented with which to determine the launch behavior of missiles and assess the accuracy of theoretical flow field prediction models A UH-1M helicopter was previously used to develop instrumentation and test methodology for conducting the airflow survey which were applied to the AH-1G test program The general test objective was to define the rotor wake boundary and three-dimensional airflow velocity components as a function of forward speed GRA

**N79-12079#** AiResearch Mfg Co Torrance Calif
**LIFT PERFORMANCE INDICATOR SYSTEM FEASIBILITY STUDY Final Report**
W J Harris Jul 1978 212 p
(Contract DAAJ02-76-C-0036)
(AD-A059238, AiResearch-78-14821 USARTL-TR-78-5) Avail NTIS HC A10/MF A01 CSCL 01/2

This report presents the results of a study that was conducted to determine the feasibility of a helicopter lift performance indicator (LPI) system that would inform the pilot of the likelihood of a successful takeoff and landing before committing the aircraft to flight The study includes the determination of the functional requirements (including accuracy) for an LPI system Four specific helicopters were considered CH-47C CH-54B UH-1H and UH-60A (UTTAS) The LPI system should be capable of informing the pilot of the vehicle s hovering capabilities (both in and out of ground effect) vertical and best-airspeed climb capabilities and several other performance measures (essentially the same type of information as contained in the performance section of the operator's manual for the vehicle) This information should be selectable for real-time and remote-site conditions (input by the pilot), for both single and dual engine operation and for maximum and normal rated power conditions Wind velocity effects should be included Generating this information in advance of lift-off requires that actual vehicle weight be measured The system should also compute center of gravity from measured weight because of its impact on performance capability and its importance with respect to cargo positioning GRA

**N79-12080#** *Advisory Group for Aerospace Research and* Development, Paris (France)
**TECHNICAL EVALUATION REPORT ON THE SPECIALISTS' MEETING OF THE FLIGHT MECHANICS PANEL ON PILOTED AIRCRAFT ENVIRONMENT SIMULATION TECHNIQUES**
K J *Staples (RAE, Bedford, England)* Oct 1978 18 p *Meeting* held at Brussels 24-27 Apr 1978
(AGARD-AR-126 ISBN-92-835-1299-5) Avail NTIS HC A02/MF A01

The proceedings of a meeting concerning the flight mechanics of and simulation techniques of piloted aircraft environments *are presented Some of the following topics are discussed* (1) requirements on simulation of the environment (2) simulation of the atmospheric environment and (3) out of the cockpit visual scenes B B

**N79-12081*#** Milco International Inc Huntington Beach Calif
**BASIC AVIONICS MODULE DESIGN FOR GENERAL AVIATION AIRCRAFT Final Report**
Richard K Smyth and David E Smyth Aug 1978 155 p
(Contract NAS1-15284)
(NASA-CR-158953) Avail NTIS HC A08/MF A01 CSCL 01D

The design of an advanced digital avionics system (basic avionics module) for general aviation aircraft operated with a single pilot under IFR conditions is described The microprocessor based system provided all avionic functions, including flight management navigation and lateral flight control The mode selection was interactive with the pilot The system used a navigation map data base to provide operation in the current and planned air traffic control environment The system design included software design listings for some of the required modules The distributed microcomputer uses the IEEE 488 bus for interconnecting the microcomputer and sensors J A M

**N79-12082** *Ohio State Univ , Columbus*
**INTERACTION OF POLICY AND STOCHASTIC EFFECTS IN AN AIR FORCE REPARABLE ITEM PROCESS A MODEL OF AIRCRAFT ENGINE AGING AND REMOVAL OVER TIME Ph D. Thesis**
Eugene Etheridge Jones 1978 196 p
Avail *Univ Microfilms Order No 7819615*

An integrated model was developed for jet aircraft engine aging and removal over calendar time which is applicable to Air *Force engine management in areas such as engine maintenance* scheduling and life cycle costing This macrolevel model treats the jet engine as a generic reparable item and its removal whether *specified by actual failure or policy, signifies a failure event for* which the logistics system generates a demand This unique model was based on the premise that the multi dimensional *data generated by the jet engine (or other reparable item) in a* strongly controlled logistics environment contain stochastic deterministic (policy-related) and other strongly biased components which need not be independent or distinguishable or yield to analysis with typical statistical methods Dissert Abstr

**N79-12083*#** National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
**PRELIMINARY STUDY OF OPTIMUM DUCTBURNING TURBOFAN ENGINE CYCLE DESIGN PARAMETERS FOR SUPERSONIC CRUISING**
Laurence H Fishbach Nov 1978 26 p refs
(NASA-TM-79047, E-9856) Avail NTIS HC A03/MF A01 CSCL 21E

The effect of turbofan engine overall pressure ratio, fan pressure ratio, and ductburner temperature rise on the engine weight and cruise fuel consumption for a mach 2 4 supersonic transport was investigated Design point engines, optimized purely for the supersonic cruising portion of the flight where the bulk of the fuel is consumed are considered Based on constant thrust requirements at cruise fuel consumption considerations would favor medium by pass ratio engines (1 5 to 1 8) of overall pressure ratio of about 16 Engine weight considerations favor low bypass ratio (0 6 or less) and low wverall pressure ratio (8) Combination of both effects results in bypass ratios of 0 6 to 0 8 and overall pressure ratio of 12 being the overall optimum A R H

**N79-12084*#** Pratt and Whitney Aircraft Group, East Hartford, Conn Commercial Products Div
**ENERGY EFFICIENT ENGINE PRELIMINARY DESIGN AND INTEGRATION STUDY**
D E Gray et al Nov 1978 362 p
(Contract NAS3-20628)
(NASA-CR-135396 PWA-5500-18) Avail NTIS HC A16/MF A01 CSCL 21E

The technology and configurational requirements of an all new 1990 s energy efficient turbofan engine having a twin spool arrangement with a directly coupled fan and low-pressure turbine a mixed exhaust nacelle and a high 38 6 1 overall pressure ratio were studied Major advanced technology design features required to provide the overall benefits were a high pressure ratio compression system, a thermally actuated advanced clearance control system, lightweight shroudless fan blades, a low maintenance cost one-stage high pressure turbine a short efficient mixer and structurally integrated engine and nacelle A conceptual design analysis was followed by integration and performance analyses of geared and direct-drive fan engines with separate or mixed exhaust nacelles to refine previously designed engine cycles Preliminary design and more detailed engine-aircraft integration analysis were then conducted on the more promising configurations Engine and aircraft sizing, fuel burned and airframe noise studies on projected 1990 s domestic and international aircraft produced sufficient definition of configurational and advanced technology requirements to allow

immediate initiation of component technology development
A R H

**N79-12085*#** National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
**EFFECT OF FLIGHT LOADS ON TURBOFAN ENGINE PERFORMANCE DETERIORATION**
E G Stakolich A Jay (Pratt and Whitney Aircraft East Hartford Conn ) E S Todd (Pratt and Whitney Aircraft East Hartford Conn ) P G Kafka (Boeing Com Airplane Co , Renton Wash ), and J L White (Boeing Com Airplane Co Renton Wash ) 1978 22 p refs Proposed for presentation at the 24th Ann Intern Gas Turbine Conf , San Diego Calif 11-15 Mar 1979 sponsored by the Am Soc of Mech Engr
(NASA-TM-79041 E-9844) Avail NTIS HC A02/MF A01 CSCL 21E

A significant percentage of high bypass ratio turbofan engine performance deterioration was caused by an increase in operating clearance between fan/compressor and turbine blades and their outer air seals These increased clearances resulted from rubs induced by a combination of engine power transients and aircraft flight loads An analytical technique for predicting the effect of quasi-steady state aircraft flight loads on engine performance deterioration was developed and is presented Thrust aerodynamic and inertia loads were considered Analytical results are shown and compared to actual engine test experience J A M

**N79-12086*#** National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
**NASA RESEARCH ON GENERAL AVIATION POWER PLANTS**
Warner L Stewart Richard J Weber Edward A Willis, and Gilbert K Sievers 1978 14 p refs Proposed for presentation at the 15th Ann Meeting and Tech Display Washington D C 6-8 Feb 1979 sponsored by AIAA
(NASA-TM-79031 E-9828) Avail NTIS HC A02/MF A01 CSCL 21A

Propulsion systems are key factors in the design and performance of general aviation airplanes NASA research programs that are intended to support improvements in these engines are described Reciprocating engines are by far the most numerous powerplants in the aviation fleet, near-term efforts are being made to lower their fuel consumption and emissions Longer-term work includes advanced alternatives such as rotary and lightweight diesel engines Work is underway on improved turbofans and turboprops Author

**N79-12087*#** Battelle Columbus Labs Ohio
**COMPUTER-AIDED ANALYSIS AND DESIGN OF THE SHAPE ROLLING PROCESS FOR PRODUCING TURBINE ENGINE AIRFOILS Final Report, 1 Oct 1976 - 30 Jun 1978**
G D Lahoti N Akgerman and T Altan Dec 1978 251 p refs
(Contract NAS3-20380)
(NASA-CR-159445) Avail NTIS HC A12/MF A01 CSCL 21E

Mild steel (AISI 1018) was selected as model cold rolling material and Ti-6A1-4V and Inconel 718 were selected as typical hot rolling and cold rolling alloys respectively The flow stress and workability of these alloys were characterized and friction factor at the roll/workpiece interface was determined at their respective working conditions by conducting ring tests Computer-aided mathematical models for predicting metal flow and stresses and for simulating the shape rolling process were developed These models utilized the upper bound and the slab methods of analysis and were capable of predicting the lateral spread roll separating force roll torque and local stresses strains and strain rates This computer-aided design system was also capable of simulating the actual rolling process and thereby designing the roll pass schedule in rolling of an airfoil or a similar shape J A M

**N79-12088*#** General Electric Co , Cincinnati Ohio
**EXPERIMENTAL CLEAN COMBUSTOR PROGRAM PHASE 3 TURBULENCE MEASUREMENT ADDENDUM Final Report**
J R Taylor Nov 1978 40 p refs
(Contract NAS3-19736)
(NASA-CR-135422 R78AEG529) Avail NTIS HC A03/MF A01 CSCL 21E

Airflow turbulence parameters were measured in the high pressure, high temperature flow stream leaving the compressor of an operating gas turbine engine A water cooled hot film turbulence probe was used to determine the turbulence intensity and length scale in the compressor exit flow stream of the CF6-50 engine Data were obtained only at idle operating conditions At engine power levels above idle conditions, durability problems and erratic data readings were encountered with the turbulence measurement probes Turbulence measurements were made at three radial immersions at a point 15 5 cm downstream of the compressor outlet guide vanes in the compressor exit diffuser The passage height at this point is 5 54 cm Data reduction was accomplished with a time-data fast Fourier transform (FFT) system This system finds the power spectral density distribution (PSD) of a large number of data samples using a direct Fourier transform algorithm and finds the autocorrelation parameter for these data by doing an FFT analysis of the PSD curves for a series of time delay intervals Author

**N79-12089#** Mitre Corp McLean, Va Metrek Div
**ATC ACCOMMODATION OF FUEL CONSERVATIVE TURBOJET OPERATIONS Final Report**
S C Mohleji R A Rucker B M Horowitz, and N O Eaddy May 1978 153 p refs
(Contract DOT-FA78WA-4075)
(AD-A059050 MTR-78-49, FAA-EM-78-14) Avail NTIS HC A08/MF A01 CSCL 21/5

Fuel savings potential of each of five fuel conservation ideas which if adopted would require significant changes to the Federal Air Regulations in the way the air traffic control system operates were estimated and compared The five ideas were (1) absorb landing delays before leaving en route airspace (2) permit cleaner, higher speed approach and landing procedures (3) lower the altitude restriction on the 250 knot speed limit in TCAs, (4) increase the number of flight levels above 29 000 feet, and (5) eliminate fixed cruise or crossing altitude restrictions Comparative estimates of the fuel saving potential of each of these ideas were developed both on a perflight basis and on an annual national basis For three of the more promising ideas the potential implementation problems and possible solutions were identified and explored B B

**N79-12090#** Boeing Military Airplane Development, Seattle, Wash
**AIRPLANE RESPONSIVE ENGINE SELECTION (ARES) VOLUME 1 ARES USER GUIDE Final Report, 15 Oct 1973 - 15 Jul 1977**
Glenn J Eckard and Michael J Healy Apr 1978 240 p refs
(Contract F33615-73-C-2084 AF Proj 3066)
(AD-A057392, AFAPL-TR-78-13-Vol-1) Avail NTIS HC A11/MF A01 CSCL 21/5

The objectives of the Airplane Responsive Engine Selection (ARES) program were to develop and apply improved analytical techniques for airplane and engine design selection and integration These objectives were attained in large part by the development of the ARES data management system, the use of which is described in this document The ARES system allows the efficient management of multi-dimensional parametric analyses with sufficient accuracy for conceptual and preliminary design activities When used properly, along the guidelines described, it will prove to be a powerful analytical tool GRA

**N79-12091#** Dayton Univ Research Inst , Ohio
**IMPACT OF SOFT BODIES ON JET ENGINE FAN BLADES Interim Report, 1 Jan - 1 Jun 1976**
John P Barber Philip F Fry John M Klyce and Henry R Taylor Apr 1977 28 p ref
(Contract F33615-75-C-5052)
(AD-A058194 UDRI-TR-76-33 AFML-TR-77-29) Avail NTIS HC A02/MF A01 CSCL 21/5

The momentum transferred to J-79 jet engine fan blades through impact with soft body projectiles was measured Impacts

onto stainless steel disks mounted normal to and 25 deg to trajectory were also investigated Elementary analytical models of the momentum transfer were constructed for each of the three configurations Author (GRA)

**N79-12092#** United Technologies Corp Stratford Conn Sikorsky Aircraft Div
**REVIEW OF ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DEVELOPMENT PROBLEMS Final Report, Aug 1977 - Mar. 1978**
W J Twomey and E H Ham Jun 1978 128 p
(Contract DAAJ02-77-C-0037 DA Proj 1L1-62209-AH-76)
(AD-A057932 SER-510003 USARTL-TR-78-13) Avail NTIS HC A07/MF A01 CSCL 21/5

The coupled interaction between two or more helicopter subsystems has often been the source of vibration problems - problems often costly and time-consuming to correct because they have not surfaced until the design and development of the individual subsystems are far advanced This report gives a review of Sikorsky experience with such problems over the past twenty years of developing gas turbine powered helicopters It represents part of an overall Government effort to accumulate data which will eventually lead to solutions of generic problems of this type The problems presented include forced vibration problems (wherein the excitations come from either aerodynamic loads on the main rotor, or mechanical imbalances in the engine/drive train), self-excited vibrations and a transient response problem GRA

**N79-12093#** Hamilton Standard Windsor Locks Conn
**TEST METHODOLOGY CORRELATION FOR FOREIGN OBJECT DAMAGE Technical Report, Mar 1976 - Dec 1977**
T Wong and Robert W Cornell Wright-Patterson AFB Ohio AFAL Mar 1978 120 p refs
(Contract F33615-76-C-5211)
(AD-A057322 AFML-TR-78-16) Avail NTIS HC A06/MF A01 CSCL 21/5

The adaptation of advanced composite materials in fan blades requires the evaluation of their resistance to damage from foreign object impacts An alternative approach to testing full-scale blades is to use laboratory material coupon impact tests and complimentary analysis methods to simulate and predict performance of composite materials in full-scale blades This study provided an assessment and development of laboratory coupon tests for evaluating potential fan blade materials Both simple and sophisticated elastic beam blade impact analyses and programs were used In the first phase, 24 impacted cantilevered and simply-supported specimens of different materials were analyzed, and the predicted maximum stressing and time history stressing and damage results were found to compare favorably with the test results Because the local and gross spanwise critical stressing occurs at separate places in the cantilever specimen but at the same location in the the simply-supported specimen and because the support action of the latter is nonlinear the cantilever specimen was found to be the better specimen to study the gross resistance of materials to impact The second phase consisted of evaluating six rotating blade impact cases and comparing the theoretical and test results The correlation was good for large missile impacts but only fair for small missile impacts GRA

**N79-12094#** Kaman Aerospace Corp Bloomfield, Conn
**ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION Final Report**
M A Bowes Jun 1978 24 p
(Contract DAAJ02-77-C-0039 DA Proj 1L2-62209-AH-76)
(AD-A058197 R-1536 USARTL-TR-78-14) Avail NTIS HC A02/MF A01 CSCL 01/3

An historical review of Kaman Aerospace Corporation helicopter development effort was conducted Information pertaining to instances of engine/airframe/drive train incompatibility was extracted from the resulting review data The details of each incompatibility problem and its solution are presented and discussed These problems were found to be associated with normally occurring rotor and drive system vibratory excitations and resonance amplified rotor and drive system vibratory excitations It is concluded that the type of incompatibility problems encountered in helicopter development programs can be expected in the future For the most part these problems, and their solutions are an intrinsic part of the development process, and they will not be eliminated through the application of increasingly more sophisticated and complex analytical design tools It is recommended that research in this area by directed towards improved dynamic testing methods which will enable more rapid efficient determination of the exact nature of future incompatibility problems, once they are encountered Author (GRA)

**N79-12095** Stanford Univ Calif
**A DESIGN METHOD WITH APPLICATION TO PREFILTERS AND SAMPLING-RATE SELECTION IN DIGITAL FLIGHT CONTROL SYSTEMS Ph D Thesis**
Uri Peled 1978 222 p
Avail Univ Microfilms Order No 7822557

The effect of prefilters on sampling rate selection is analyzed by comparing the noise response of several systems designed over a wide range of prefilter breakpoint frequencies and sampling rates, but all with the same response to output commands A model-following design method was developed to match the step response of the system output to the step response of a model in the presence of deterministic disturbances and/or random process and measurement noise This method was applied successfully to an integrator as a plant the short period motion of the F-8 aircraft, and wing flutter control Simple compensations achieve good performance Low noise response and good output command response are obtained at prefilter breakpoint frequencies as low as the bandwidth thereby reducing the sampling rate to as low as twice the bandwidth Other factors determining low sampling rate are reviewed and related to a proposed low sampling rate selection procedure Dissert Abstr

**N79-12096*#** National Aeronautics and Space Administration Flight Research Center Edwards Calif
**EFFECT OF SAMPLING RATE AND RECORD LENGTH ON THE DETERMINATION OF STABILITY AND CONTROL DERIVATIVES**
Martin J Brenner Kenneth W Iliff and Robert K Whitman Dec 1978 140 p refs
(NASA-TM-72858 H-1077) Avail NTIS HC A07/MF A01 CSCL 01C

Flight data from five aircraft were used to assess the effects of sampling rate and record length reductions on estimates of stability and control derivatives produced by a maximum likelihood estimation method Derivatives could be extracted from flight data with the maximum likelihood estimation method even if there were considerable reductions in sampling rate and/or record length Small amplitude pulse maneuvers showed greater degradation of the derivative maneuvers than large amplitude pulse maneuvers when these reductions were made Reducing the sampling rate was found to be more desirable than reducing the record length as a method of lessening the total computation time required without greatly degrading the quantity of the estimates Author

**N79-12097#** Illinois Univ at Urbana-Champaign Urbana Decision and Control Lab
**FEEDBACK CONTROLLED AIRCRAFT SENSITIVITY TO PARAMETER VARIATIONS M S Thesis**
Robert Lea Jackson Aug 1977 75 p refs
(Contract DAAB07-72-C-0259 Grant AF-AFOSR-2570-73)
(AD-A057643 DC-13 UILU-ENG-77-2252, R-806) Avail NTIS HC A04/MF A01 CSCL 01/3

This report is concerned with a sensitivity study of a flight control design using optimal control theory and observer theory A simplified model of an airplane s vertical motion is used Hybrid computer simulation indicates that the linearized design is satisfactory only if the operating conditions are not too drastically different from the nominal, and that a multipoint design or an adaptive control design might be preferable Author (GRA)

**N79-12098#** Air Force Inst of Tech , Wright-Patterson AFB Ohio School of Engineering
**AN ANALYSIS OF THE STABILITY OF AN AIRCRAFT EQUIPPED WITH AN AIR CUSHION RECOVERY SYSTEM M.S Thesis**

Max Allen Stafford Mar 1978 222 p refs
(AD-A057434, AFIT/GGC/EE-78M-5) Avail NTIS HC A10/MF A01 CSCL 01/3

The stability of an aircraft equipped with an air cushion recovery system (ACRS) was investigated both in-flight and during the landing (slideout) phase of flight Digital computer simulations were used to identify unstable tendencies of a specific aircraft (the Jindivik drone) Control system designs are proposed to eliminate the instabilities A nonlinear six degree of freedom, aerodynamic model is developed based on available wind-tunnel data The model is used in a computer software package, EASY to simulate the vehicle in flight A model of the air cushion recovery system is also developed The model is generated by matching experimental data obtained from an actual ACRS with 14 spring/damper units The model is verified by computer simulation and the slideout simulations are performed These simulations reveal a lateral-directional instability in the slideout An optimal control design is proposed and verified after which it is shown that the stability of the system is dramatically enhanced by the addition of an optimal controller GRA

**N79-12099#** Dunlay (William J, Jr) Bala Cynwyd, Pa
**AIRPORT IMPROVEMENT TASK FORCE DELAY STUDY DATA COLLECTION, REDUCTION AND ANALYSIS Final Report, 18 Aug - 22 Nov 1977**
William J Dunlay Jr Nov 1977 53 p refs Sponsored by FAA
(AD-A056201, FAA-EM-78-7) Avail NTIS HC A04/MF A01 CSCL 01/5

A plan is presented for the collection, reduction, and analysis of data in support of the validation of an airside delay simulation model Data collection forms are presented along with the forms on which data are reduced and finally merged from several sources into a single summary format by aircraft Detailed suggestions are given for the statistical analysis of model estimates and for a time series analysis of these estimates vis-a-vis corresponding observed data Included are guidelines for interpreting the results of the statistical tests Author

**N79-12100#** Army Engineer Waterways Experiment Station Vicksburg Miss
**LITERATURE REVIEW-ELASTIC CONSTANTS FOR AIRPORT PAVEMENT MATERIALS Final Report**
James L Green Mar 1978 140 p refs
(Contract DOT-FA73WAI-377)
(AD-A056195 FAA-RD-76-138) Avail NTIS HC A07/MF A01 CSCL 01/5

A literature review was made to support an ongoing study to develop a method for evaluating airport pavements based on the layered elastic theory and using constants as determined from vibratory test results The review covered the definitions and relations between elastic constants, methods used by various researchers for measuring elastic constants and values of elastic constants found (or used) by various researchers The review also included a study to determine the sensitivity of pavement responses to arbitrarily assigned values of elastic constants and an examination of the relationships between vibrator test results and elastic constants The latter subject included a special preliminary examination of the relationship between the results from tests with the WES 16 kip vibrator and elastic constants A summary discussion was given of the findings from the literature review and the special preliminary examination Finally, recommendations were made to facilitate further planning and implementation of the ongoing study mentioned Author

**N79-12101#** Naval Postgraduate School, Monterey Calif
**AN EXPERIMENTAL INVESTIGATION OF TURBOJET TEST CELL AUGMENTORS M S Thesis**
Charles Nim Sapp Jr Jun 1978 72 p refs
(AD-A057903) Avail NTIS HC A04/MF A01 CSCL 14/2

A one-eighth scale turbojet test cell was used to investigate the effects of various design parameters on augmentor performance The augmentor inlet design nozzle-to-augmentor spacing engine flow rate nozzle total temperature and pressure and augmentor tube diameter were varied to determine what effect they had on augmentation ratio, total air pumped through the system and pressure temperature, and velocity distributions within the augmentor tube In addition, two augmentor tubes were combined in tandem to investigate the characteristics of a tertiary augmentor configuration Author (GRA)

**N79-12102#** Air Force Human Resources Lab Brooks AFB, Tex
**EVALUATION OF A LOW FIDELITY SIMULATOR (LFS) FOR INSTRUMENT TRAINING Interim Report, Apr 1976 - Oct. 1977**
John V Crosby, Lawrence D Pohlmann Barry Leshowitz, and Wayne L Waag Jul 1978 14 p refs
(AF Proj 2313)
(AD-A058139) Avail NTIS HC A02/MF A01 CSCL 01/4

The objective of this study was to investigate the transfer of training from a low fidelity simulator (LFS) to a higher fidelity device and subsequently to the aircraft An attempt was made to determine both the magnitude of transfer as well as the temporal duration of the effect A transfer of training design was employed using 14 students entering Undergraduate Pilot Training (UPT) Subjectives were divided into two equal groups (n = 7) One group received pretraining on the LFS while the other did not LFS training consisted of 10 hours of basic instrument instruction conducted over a 2 week period prior to UPT entry During LFS training students were advanced on a proficiency basis using objectively derived scoring procedures Author (GRA)

**N79-12103#** Army Research Office Washington, D C
**CALIBRATION OF THE AEDC-PWT 16-FOOT TUNNEL WITH THE PROPULSION TEST SECTION AT VARIOUS REYNOLDS NUMBERS Final Report, Oct 1974 - Jun 1975**
F M Jackson Aug 1978 103 p refs
(AD-A057877 AEDC-TR-77-121) Avail NTIS HC A06/MF A01 CSCL 14/2

Tests were conducted in the AEDC Propulsion Wind Tunnel (16T) to determine the tunnel test section Mach number distributions and calibration at various Reynolds numbers The calibration was conducted at Mach numbers from 0 2 to 1 6 and at Reynolds numbers from 400 000/ft to 6 400 000/ft The calibration was conducted using the propulsion test section (Test Section 1) and centerline pipe and wall pressure orifices to define the Mach number distributions A quantitative evaluation of the effects of tunnel pressure ratio test section wall angle and Reynolds number on the centerline Mach number distributions was determined by analysis of the local Mach number deviations The results indicate that Mach number distributions of good quality are obtained for both zero and the optimum wall angle schedule For complete generality the Tunnel 16T calibration must be defined as a function of test section wall angle Reynolds number, and Mach number GRA

**N79-12104#** Aeronautical Systems Div Wright-Patterson AFB, Ohio
**AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS TEST FACILITIES AND TEST EQUIPMENT Annual Report, calendar year 1978**
Donald C Kittinger Apr 1978 47 p refs Supersedes ASD-TR-77-3
(AD-A058209, ASD-TR-78-22 ASDOTR-77-3) Avail NTIS HC A03/MF A01 CSCL 05/1

This report is a part of a compilation of formalized Technology Needs (TN) covering Equipment Subsystems as identified by the Aeronautical Systems Division They are based on development/operational experience system studies and new concepts - all related to future system applications Their presentation is to serve a threefold purpose, i e (1) guidance for technology program, (2) proven development potential, and (3) engineering data/requirements essential for technology use in systems GRA

**N79-12151*#** Boeing Commercial Airplane Co Seattle Wash
**DEVELOPMENT OF AIRCRAFT LAVATORY COMPARTMENTS WITH IMPROVED FIRE RESISTANCE CHARACTERISTICS, PHASE 1 FIRE CONTAINMENT TEST OF A WIDE BODY AIRCRAFT LAVATORY MODULE Final Report**

R A Anderson D B Arnold G A Johnson and E A Tustin Jul 1978 84 p
(Contract NAS2-8700)
(NASA-CR-152074, D6-44885) Avail NTIS HC A05/MF A01 CSCL 11D

A test was conducted to evaluate the fire containment characteristics of a Boeing 747 lavatory module Results showed that the fire was contained within the lavatory during the 30-minute test period with the door closed The resistance of the lavatory wall and ceiling panels and general lavatory construction to burn-through under the test conditions was demonstrated Author

**N79-12156*#** National Aeronautics and Space Administration Langley Research Center, Hampton, Va
**REPRODUCIBILITY OF STRUCTURAL STRENGTH AND STIFFNESS FOR GRAPHITE-EPOXY AIRCRAFT SPOILERS**
William E Howell and Charles D Reese (Kansas Univ, Lawrence) Nov 1978 23 p refs
(NASA-TM-78723) Avail NTIS HC A02/MF A01 CSCL 11D

Structural strength reproducibility of graphite epoxy composite spoilers for the Boeing 737 aircraft was evaluated by statically loading fifteen spoilers to failure at conditions simulating aerodynamic loads Spoiler strength and stiffness data were statistically modeled using a two parameter Weibull distribution function Shape parameter values calculated for the composite spoiler strength and stiffness were within the range of corresponding shape parameter values calculated for material property data of composite laminates This agreement showed that reproducibility of full scale component structural properties was within the reproducibility range of data from material property tests Author

**N79-12204*#** National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
**WEAR OF SEAL MATERIALS USED IN AIRCRAFT PROPULSION SYSTEMS**
Robert C Bill and Lawrence P Ludwig 1978 30 p refs Presented at the Mater and Processing Congr, Philadelphia, 7-9 Nov 1978 Prepared in cooperation with Army Aviation Research and Development Command St Louis, Mo
(NASA-TM-79003, E-9789 AVRADCOM-TR-78-47) Avail NTIS HC A03/MF A01 CSCL 11F

The various types of seal locations in a gas turbine engine are described, and the significance of wear to each type is reviewed Starting with positive contact shaft seals, existing material selection guidelines are reviewed, and the existing PV (contact pressure X sliding velocity) criteria for selecting seal materials are discussed along with the theoretical background for these criteria Examples of wear mechanisms observed to operate in positive contact seals are shown Design features that can extend the operating capabilities of positive contact seals, including pressure balancing and incorporation of hydrodynamic lift are briefly discussed It is concluded that, despite the benefits arising from these design features improved positive contact seal materials from the standpoint of wear, erosion and oxidation resistance will be necessary for further improvements in seal performance and durability, and to meet stringent future challenges Author

**N79-12207#** Lockheed-California Co, Burbank Structures and Materials
**COMPARISON OF ENGINEERING PROPERTIES OF 7050-T7E73 AND 7075-T6510 EXTRUSIONS FOR POTENTIAL P-3 APPLICATIONS Final Report, 30 Nov 1976 - 27 Feb 1978**
Roy W Brodie and Leon Bakow Feb 1978 111 p refs
(Contract N62269-77-C-0024)
(AD-A058002 LR-28499, NADC-76269-30) Avail NTIS HC A06/MF A01 CSCL 11/6

7050-T7E73 extrusion material was procured in P-3 wing spar cap and plank shapes for direct comparative testing with current 7075-T6510 production extrusions Three lots of 7050-T7E73 were produced and processed in production facilities to be representative of actual part fabrication Comparable 7075-T6 tensile strengths and improved exfoliation, and fatigue properties were obtained with the 7050-T7E73 material Significant improvements were obtained in crack propagation in approximately 40% R H and approximately 98% R H environments where the crack growth threshold showed an approximately 30% increase and the crack growth rate was approximately 67% slower for the 7050-T7E73 material The 7050-T7E73 also had a 60 to 70% improvement in fracture toughness at room temperature and -65 F over the 7075-T6510 material and the -65 F toughness of 7050-T7E73 was 30% higher than the room temperature toughness of 7075-T6510 Author (GRA)

**N79-12223*#** National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
**DEVELOPMENT OF SPRAYED CERAMIC SEAL SYSTEMS FOR TURBINE GAS PATH SEALING**
Robert C Bill (AVRADCOM Res and Technol Labs) L T Shiembob (Pratt and Whitney Aircraft Group East Hartford Conn), and O L Stewart (Pratt and Whitney Aircraft Group, East Hartford Conn) 1978 22 p refs Presented at the Winter Ann Meeting, San Francisco 10-15 Dec 1978 sponsored by Am Soc of Mech Engr
(NASA-TM-79022, E-9819 AVRADCOM-TR-78-52) Avail NTIS HC A02/MF A01 CSCL 11A

A ceramic seal system is reported that employs plasma-sprayed graded metal/ceramic yttria stabilized zirconium oxide (YSZ) The performance characteristics of several YSZ configurations were determined through rig testing for thermal shock resistance, abradability, and erosion resistance Results indicate that this type of sealing system offers the potential to meet operating requirements of future gas turbine engines G G

**N79-12226#** North Dakota State Univ Fargo
**WATERBORNE COATINGS FOR AIRCRAFT Interim Report, 1 Jun. - 31 Dec 1977**
Loren W Hill May 1978 34 p refs
(Contract F33615-77-C-5003 AF Proj 2422)
(AD-A057783 AFML-TR-78-44) Avail NTIS HC A03/MF A01 CSCL 01/3

The purpose of this work was to determine the potential of waterborne polymers for use in high performance coatings for aircraft The impetus for replacing current solvent-borne aircraft topcoats and primers is to reduce air pollution associated with solvent emissions The approach was to obtain information on current waterborne technology by carrying out a literature search and by consultations with coatings scientists from coatings companies raw materials suppliers, and institutes The information obtained was evaluated with regard to suitability of various waterborne coatings for use under conditions required in aircraft coating procedures such as spray application and ambient-temperature cure It was concluded that none of the currently available waterborne systems are suitable for replacement of current Air Force topcoats and primers without additional research and development Waterborne replacements under current development were ranked according to potential for achieving the high performance required of aircraft coatings and some of the problems anticipated for each type were identified Author (GRA)

**N79-12242#** Civil and Environmental Engineering Development Office, Tyndall AFB Fla Environmental Sciences Research Div
**OXIDATION OF HYDRAZINE IN AQUEOUS SOLUTIONS Interim Report, 6 Jan 1977 - 1 Jan 1978**
Michael G MacNaughton Gregory A Urda, and Sue E Bowden Mar 1978 37 p refs
(AD-A058239, CEEDO-TR-78-11) Avail NTIS HC A03/MF A01 CSCL 21/4

The expanded use of hydrazine type fuels throughout the Air Force makes it imperative that current and accurate data be available on the potential environmental impact of these compounds This report describes the chemistry of hydrazine in aqueous solutions under varying conditions of temperature, pH ionic strength, salinity, hydrazine concentration oxygen concentration and in the presence of catalysts, and solid substrates Results indicate that in the absence of Copper 2 as a catalyst the degradation of hydrazine is slow In five days a 1 x ten to the minus 4th power molar solution of hydrazine degraded less than

2% in distilled water 40% in pond water and 20% in seawater The addition of oxide and clay solids did not change the rate of degradation Increasing the concentration of Copper 2 caused a major increase in the oxidation rate as did increasing temperature Salinity and ionic strength changes caused minor variations in rate The maximum degradation rate occurs between pH8 and 9 Oxygen concentrations in the range 0 5 to 40 mg/l had no measurable effect Author (GRA)

**N79-12245#** Air Force Inst of Tech Wright-Patterson AFB Ohio School of Systems and Logistics
**PREDICTION OF SELECTED JET FUEL TEST RESULTS USING ASTM TEST METHOD D2887 DATA WITH MULTIPLE LINEAR REGRESSION ANALYSIS M S Thesis**
Ronald W Roof and Harvey Yates Jun 1978 80 p refs
(AD-A059185 AFIT-LSSR-26-78A) Avail NTIS HC A05/MF A01 CSCL 21/4

At the present time to analyze a five gallon sample of JP-4 requires approximately 24 hours with over thirty separate tests to determine overall sample acceptability The time required to ship the sample from bases and distribution points to central laboratory facilities and to disseminate the results is considerable This research attempted to identify those boiling points from the simulated distillation curve which could be used to predict other JP-4 test results such as API Gravity, Aniline Gravity Product RVP Water Separometer Index Modified without the requirement to perform these tests The research used multiple linear regression techniques to obtain the algorithms for the above JP-4 tests Models developed by these techniques did not attain the level of accuracy needed to delete the requirement for physically completing the above tests However several ideas are presented for use by future teams performing research in predicting fuel properties from simulated distillation data Author (GRA)

**N79-12465#** Dayton Univ Ohio Research Inst
**THE CHARPY IMPACT TEST AS A METHOD FOR EVALUATING IMPACT RESISTANCE OF COMPOSITE MATERIALS Technical Report, Sep 1976 - Sep. 1977**
Dennis C Krinke, John P Barber and Theodore Nicholas Apr 1978 44 p refs
(Contract F33615-76-C-5124)
(AD-A057967 UDRI-TR-77-54, AFML-TR-78-54) Avail NTIS HC A03/MF A01 CSCL 11/4

A detailed analysis of the three point bend (Charpy Impact) test was conducted A simple strength of materials approach to the prediction of specimen response was extended to include shear deformation shear yielding and local loading tup deformation Load-deflection, energy absorbed and failure modes were predicted for graphite-epoxy, and two types of boron-aluminum composites Experiments were then conducted on these materials and the observations compared to the predictions The analysis was unable to predict specimen response accurately, especially when significant shear deformation or yielding occurred GRA

**N79-12585*#** National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
**AIR POLLUTION FROM AIRCRAFT OPERATIONS AT SAN JOSE MUNICIPAL AIRPORT, CALIFORNIA**
Edward T Schairer Nov 1978 23 p refs
(NASA-TM-78506 A-7523) Avail NTIS HC A03/MF A01 CSCL 13B

The amount of air pollution discharged by arriving and departing aircraft at the San Jose Municipal Airport was estimated These estimates were made for each one hour interval of a summer weekday in 1977 The contributions of both general aviation (personal and business aircraft) and certified air carriers (scheduled airliners) were considered The locations at which the pollutants were discharged were estimated by approximating the flight paths of arriving and departing aircraft Three types of pollutants were considered carbon monoxide hydrocarbons and oxides of nitrogen S B S

**N79-12593#** National Technical Information Service Springfield Va
**NITROGEN OXIDE AIR POLLUTION PART 3 ATMOSPHERIC CHEMISTRY A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug 1978**
Diane M Cavagnaro Sep 1978 230 p Supersedes NTIS/PS-77/0853
(NTIS/PS-78/0973/4 NTIS/PS-77/0853) Avail NTIS HC $28 00/MF $28 00 CSCL 04A

Photochemical air pollution models smog chemistry and reactivity and SST exhaust effects are covered in the bibliography Auroral and upper atmospheric chemistry and photochemistry of naturally occurring nitrogen oxides are excluded This updated bibliography contains 224 abstracts 52 of which are new entries to the previous edition GRA

**N79-12750#** Naval Postgraduate School Monterey Calif
**MICROCOMPUTER BASED FLIGHT DATA RECORDER/MONITOR WITH SOLID STATE MEMORY M S Thesis**
Darl Eugene Easton Jun 1978 145 p refs
(AD-A057990) Avail NTIS HC A07/MF A01 CSCL 01/4

The design breadboard implementation and functional testing of a Digital Flight Data Recorder/Monitor prototype is reported Microcomputer interfacing to Magnetic Bubble Memory and a digital data bus was accomplished The microcomputer is to be used to collect and analyze flight parameters and record only significant data for later use in an accident investigation or maintenance debriefings for accident prevention The Magnetic Bubble Memory is the nonvolatile recording media The digital data bus interface to the IEEE 488 instrument bus will allow operational testing of the recorder on an aircraft equipped with a complete data acquisition system Author (GRA)

**N79-12998** Washington Univ , Seattle
**EFFECT OF STRUCTURAL PARAMETERS ON THE FLAP-LAG FORCED RESPONSE OF A ROTOR BLADE IN FORWARD FLIGHT Ph.D Thesis**
Daniel Patrick Schrage 1978 104 p
Avail Univ Microfilms Order No 7823149

Research conducted to obtain a better understanding of the structural coupling parameters that contribute to rotor blade forced response and stability in forward flight is reported A new analytical method, named eigenvalue and modal decoupling analysis, was developed to solve the flap-lag equations of motion with periodic coefficients An extension of the Floquet Transition Matrix Method, the eigenvalue and modal decoupling analysis is used to obtain the forced response of the flap-lag equations Application of this analysis to study four different rotor configurations has provided new insight into the stability and response problem The results obtained from an analysis that provides rotor loads and stability simultaneously give the rotor design engineer valuable guidelines to study the tradeoffs necessary during the design phase of new rotor systems Dissert Abstr

**N79-13000*#** National Aeronautics and Space Administration Langley Research Center, Hampton, Va
**EFFECTS OF THICKNESS ON THE AERODYNAMIC CHARACTERISTICS OF AN INITIAL LOW-SPEED FAMILY OF AIRFOILS FOR GENERAL AVIATION APPLICATIONS**
Robert J McGhee and William D Beasley Jun 1978 51 p refs
(NASA-TM-X-72843) Avail NTIS HC A04/MF A01 CSCL 01A

Wind tunnel tests were conducted to determine the effects of airfoil thickness-ratio on the low speed aerodynamic characteristics of an initial family of airfoils The results were compared with theoretical predictions obtained from a subsonic viscous method The tests were conducted over a Mach number range from 0 10 to 0 28 Chord Reynolds numbers varied from about 2 0 x 1 million to 9 0 x 1 million G G

**N79-13001*#** Lockheed-Georgia Co , Marietta
**ANALYSIS OF A THEORETICALLY OPTIMIZED TRANSONIC AIRFOIL**
M E Lores, K P Burdges, and G D Shrewsbury Nov 1978 102 p refs
(Contract NAS2-8697)
(NASA-CR-3065, LG78ER0212) Avail NTIS HC A06/MF A01 CSCL 01A

Numerical optimization was used in conjunction with an inviscid full potential equation transonic flow analysis computer code to design an upper surface contour for a conventional airfoil

to improve its supercritical performance The modified airfoil was tested in a compressible flow wind tunnel The modified airfoil's performance was evaluated by comparison with test data for the baseline airfoil and for an airfoil developed by optimization of leading edge of the baseline airfoil While the leading edge modification performed as expected the upper surface re-design did not produce all of the expected performance improvements Theoretical solutions computed using a full potential, transonic airfoil code corrected for viscosity were compared to experimental data for the baseline airfoil and the upper surface modification These correlations showed that the theory predicted the aerodynamics of the baseline airfoil fairly well but failed to accurately compute drag characteristics for the upper surface modification S B S

N79-13002*# National Aeronautics and Space Administration Langley Research Center, Hampton Va
EFFECTS OF WING LEADING-EDGE FLAP DEFLECTIONS ON SUBSONIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A WING-FUSELAGE CONFIGURATION WITH A 44 DEG SWEPT WING
William P Henderson Nov 1978 38 p refs
(NASA-TP-1351, L-12481) Avail NTIS HC A03/MF A01 CSCL 01A

An investigation was conducted to determine the effects of wing leading-edge flap deflections on the subsonic longitudinal aerodynamic characteristics of a wing-fuselage configuration with a 44 deg swept wing The tests were conducted at Mach numbers from 0 40 to 0 85, corresponding to Reynolds numbers (based on wing mean geometric chord) of 2 37 x 1,000 000 to 4 59 x 1,000,000 and at angles of attack from -3 deg to 22 deg The configurations under study included a wing-fuselage configuration and a wing-fuselage-strake configuration Each configuration had multisegmented, constant-chord leading-edge flaps which could be deflected independently or in various combinations Author

N79-13003*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
ANALYSIS OF SUPERSONIC STALL BENDING FLUTTER IN AXIAL-FLOW COMPRESSOR BY ACTUATOR DISK THEORY
John J Adamczyk Nov 1978 58 p refs
(NASA-TP-1345, E-9186) Avail NTIS HC A04/MF A01 CSCL 01A

An analytical model was developed for predicting the onset of supersonic stall bending flutter in axial-flow compressors The analysis is based on two-dimensional, compressible, unsteady actuator disk theory It is applied to a rotor blade row by considering a cascade of airfoils The effects of shock waves and flow separation are included in the model Calculations show that the model predicts the onset, in an unshrouded rotor of a bending flutter mode that exhibits many of the characteristics of supersonic stall bending flutter The validity of the analysis for predicting this flutter mode is demonstrated Author

N79-13004*# Northrop Corp, Hawthorne Calif Aircraft Div
INVESTIGATION OF STEADY AND FLUCTUATING PRESSURES ASSOCIATED WITH THE TRANSONIC BUFFETING AND WING ROCK OF A ONE-SEVENTH SCALE MODEL OF THE F-5A AIRCRAFT Final Report
Chintsun Hwang and W S Pi Nov 1978 213 p refs
(Contract NAS2-8734)
(NASA-CR-3081) Avail NTIS HC A10/MF A01 CSCL 01A

A wind tunnel test of a 1/7 scale F-5A model is described The pressure, force, and dynamic response measurements during buffet and wing rock are evaluated Effects of Mach number, angle of attack, sideslip angle, and control surface settings were investigated The mean and fluctuating static pressure data are presented and correlated with some corresponding flight test data of a F-5A aircraft Details of the instrumentation and the specially designed support system which allowed the model to oscillate in roll to simulate wing rock are also described A limit cycle mechanism causing wing rock was identified from this study, and this mechanism is presented G Y

N79-13005*# Bell Helicopter Co, Fort Worth, Tex
EXPERIMENTAL INVESTIGATION OF THE SUBWING TIP AND ITS VORTEX STRUCTURE Final Report
James L Tangler Washington NASA Nov 1978 50 p refs
(Contract NAS1-14465)
(NASA-CR-3058) Avail NTIS HC A03/MF A01 CSCL 01A

A better understanding of the subwing's vortex structure relative to a square tip for several angles of attack and yaw angles is provided This comparison included subwings of various chord size and airfoil thickness Flow visualization together with performance and wake measurements, provided a comparison between the square tip and subwing tips during both a semi-span wind-tunnel test and a small-scale rotor hover-stand test G Y

N79-13006*# Old Dominion Univ Research Foundation, Norfolk, Va
ANALYTICAL STUDIES OF SEPARATED VORTEX FLOW ON HIGHLY SWEPT WINGS Final Report
John M Kuhlman Washington NASA Nov 1978 65 p
(Grant NsG-1357)
(NASA-CR-3022) Avail NTIS HC A04/MF A01 CSCL 01A

A subsonic potential flow mathematical model of the flow past slender aerodynamic surfaces with sharp edges and separated vortex flow is reported Comparisons with experimental data are presented for overall forces and pressure distributions for a series of thin, low aspect ratio wings, including both flat and conically cambered ones A discussion is presented of the limitations of the current theory and some suggestions are made as to how the theory might be improved Details of program data input modifications for three-dimensional geometry are described in an appendix G G

N79-13007*# Applied Research Lab, State College Pa
MEASUREMENTS OF INLET FLOW DISTORTIONS IN AN AXIAL FLOW FAN (0 AND 9 BLADE ROTOR)
L C Barr 10 Oct 1978 551 p refs
(Grant NsG-3031)
(NASA-CR-157842, TM-78-252) Avail NTIS HC A24/MF A01 CSCL 01A

A large quantity of experimental data on inlet flow distortions in an axial flow fan were obtained The purpose of the study was to determine the effects of design and operating variables and the type of distortion on the response of an axial flow turbomachinery rotor Included are background information and overall trends observed in distortion attenuation and unsteady total pressure losses G G

N79-13011# Air Force Flight Dynamics Lab, Wright-Patterson AFB, Ohio
EXPERIMENTAL MEASUREMENT OF PARACHUTE CANOPY STRESS DURING INFLATION Final Report, 1 Jul. 1975 - 30 Dec 1976
Peggy M Wagner May 1978 185 p refs
(AF Proj 6065)
(AD-A058474, AFFDL-TR-78-53) Avail NTIS HC A09/MF A01 CSCL 01/3

The Omega sensor was developed for measuring stress in textile and other flexible materials by the Department of Aerospace Engineering and Mechanics of the University of Minnesota and sponsored by the Air Force Flight Dynamics Laboratory Two studies were conducted by the University which indicated that the circumferential stresses of inflated parachute canopies indicated by Omega sensors agreed with theoretically predicted stresses and also that the stresses measured by an Omega sensor were not effected by dynamic loading This particular study deals with an in-house test program, designed to measure the circumferential stresses of a model (five foot nominal diameter) ringslot parachute during inflation and at steady state using modified Omega sensors Slight modifications to the original Omega sensor had to be made due to complications of the tabs tearing during preliminary testing Five sensors were attached strategically to the canopy of a ringslot parachute and put through a series of low speed wind tunnel tests The results are presented in detail and provide for the first time actual measurement of circumferential stresses on the surface of a model ringslot parachute These results, however, can only present the general

trend shown in the parachute's stress distribution and not actual stress values due to the inability to calibrate the sensor while attached to the canopy Author (GRA)

N79-13019# Goodyear Aerospace Corp Akron, Ohio
FEASIBILITY DESIGN STUDY FOR SCALE MODEL OF ZPG-X AIRSHIP Final Report
J W Lancaster Jun 1978 75 p refs
(Contract N62269-77-M-4260, WF41411000)
(AD-A058624, GER-16558, NADC-77265-30) Avail NTIS HC A04/MF A01 CSCL 01/3

This report documents a Feasibility Design Study of a scale model of the ZPG-X airship which would demonstrate the VTOL and hover capability of this vehicle concept Author (GRA)

N79-13018*# Ohio Univ, Athens Avionics Engineering Center
INITIAL FLIGHT TEST OF A LORAN-C RECEIVER/DATA COLLECTION SYSTEM
Joseph P Fischer and James D Nickum Nov 1978 46 p refs
(Grant NGR-36-009-017)
(NASA-CR-157629, TM-64) Avail NTIS HC A03/MF A01 CSCL 17G

Development of a low cost Loran C receiver for general aviation use is discussed The preparation and procedure of a flight test conducted with a receiver design which utilizes a phase locked loop oscillator to track the Loran C signals is described It is indicated that such a receiver is a viable alternative for future work in developing a low cost Loran-C navigator J M S

N79-13019*# Ohio Univ, Athens Avionics Engineering Center
LORAN-C TIME DIFFERENCE CALCULATIONS
Joseph P Fischer Oct 1978 10 p refs
(Grant NGR-36-009-017)
(NASA-CR-157957, TM-63) Avail NTIS HC A02/MF A01 CSCL 17G

Some of the simpler mathematical equations which may be used in Loran-C navigation calculations were examined A technique is presented to allow Loran-C time differences to be predicted at a location This is useful for receiver performance work and a tool for more complex calculations, such as position fixing B B

N79-13021# Sperry Rand Corp, Great Neck, N Y
SLIC-7 LASER GYRO INVESTIGATIONS Final Technical Report, Jul. - Dec 1977
John Abdale and Werner Drexel Mar 1978 88 p refs
(Contract F33615-77-C-1196)
(AD-A059028 SG-4240-1027, AFAL-TR-78-32) Avail NTIS HC A05/MF A01 CSCL 17/7

This program is the initial phase of an effort to develop laser gyro technology for application to low cost inertial missile guidance systems As part of the research and development effort two investigations of SLIC-7 laser gyro were conducted (1) thermal analysis and (2) storage and shelf life evaluation The key to quick reaction and performance stability is the design to minimize thermal gradients and therefore, thermal sensitivities Test results disclose that the thermal gradients across the discharge tubes are the key factors Analyses indicate that the SLIC-7 gyro can meet the low thermal sensitivity goals and the storage and shelf life requirements postulated for the missile guidance systems Author (GRA)

N79-13022# Arinc Research Corp Annapolis, Md
DEVELOPMENT AND EVALUATION OF SELECTIVE ADDRESS BEACON (SAD) SYSTEM Final Report
S H Kowalski Aug 1978 117 p ref
(Contract DOT-FA76WA-3788)
(AD-A058457, Rept-1326-11-2-1734) Avail NTIS HC A06/MF A01 CSCL 17/7

This report presents the results of the development and evaluation of a selective address beacon system intended to reduce or eliminate synchronous garble in dense airspace Two concepts are developed and evaluated, depending on the expected application of SAB as either an interim or long-term solution of the synchronous garble problem The degree of improvement expected from each concept is evaluated and the communications reliability is analyzed Avionics designs supporting the concepts are developed and avionics cost estimated for the air carrier and general aviation classes of aircraft Author (GRA)

N79-13023# Arinc Research Corp, Annapolis, Md
INVESTIGATION OF THE FEASIBILITY OF USING THE DISCRETE ADDRESS BEACON SYSTEM DATA LINK FOR NON-ATC COMMUNICATIONS Final Report
S H Kowalski, E R Carbone, W M Kolb, and D A Swann Aug 1978 77 p
(Contract DOT-FA76WA-3788)
(AD-A058453, Rept-1326-01-05-1792) Avail NTIS HC A05/MF A01 CSCL 17/7

This report presents the results of a study to investigate the suitability of the DABS to support airline industry private communications between aircraft in flight and ground operations The present proposed near future, and possible future communication traffic is identified DABS models for uplink traffic, downlink traffic and message scheduling are developed and exercised over a broad spectrum of conditions for both en route and terminal area communications A simulation is performed to determine the probable delays due to queuing for the various levels of implementation and with various numbers of aircraft Author (GRA)

N79-13026*# General Dynamics/Convair, San Diego, Calif
VEHICLE DESIGN EVALUATION PROGRAM (VDEP) A COMPUTER PROGRAM FOR WEIGHT SIZING, ECONOMIC, PERFORMANCE AND MISSION ANALYSIS OF FUEL-CONSERVATIVE AIRCRAFT, MULTIBODIED AIRCRAFT AND LARGE CARGO AIRCRAFT USING BOTH JP AND ALTERNATIVE FUELS
B H Oman Jan 1977 426 p refs
(Contract NAS1-13285)
(NASA-CR-145070) Avail NTIS HC A19/MF A01 CSCL 01C

The NASA Langley Research Center vehicle design evaluation program (VDEP-2) was expanded by (1) incorporating into the program a capability to conduct preliminary design studies on subsonic commercial transport type aircraft using both JP and such alternate fuels as hydrogen and methane,(2) incorporating an aircraft detailed mission and performance analysis capability, and (3) developing and incorporating an external loads analysis capability The resulting computer program (VDEP-3) provides a preliminary design tool that enables the user to perform integrated sizing, structural analysis, and cost studies on subsonic commercial transport aircraft Both versions of the VDEP-3 Program which are designated preliminary Analysis VDEP-3 and detailed Analysis VDEP utilize the same vehicle sizing subprogram which includes a detailed mission analysis capability as well as a geometry and weight analysis for multibodied configurations A R H

N79-13027# Army Aviation Engineering Flight Activity, Edwards AFB Calif
PRELIMINARY AIRWORTHINESS EVALUATION EH-1H HELICOPTER QUICK FIX, PHASE 1A Final Report
Robert M Buckanin and Jerry R Guin Oct 1977 46 p refs
(AD-A058785, USAAEFA-77-15) Avail NTIS HC A03/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a Preliminary Airworthiness Evaluation of the EH-1H Helicopter Quick Fix Phase 1A to determine the effects of the installation of the AN/ARQ-33 radio countermeasures system and its associated equipment on aircraft handling qualities The helicopter was tested from 18 through 23 August 1977 at Naval Air Station Pensacola, Florida During the tests nine flights totaling 8 5 productive flight hours were flown The handling qualities of the EH-1H helicopter were determined to be satisfactory with the exception of inadequate directional control in right sideward flight An enhancing characteristic noted was the simultaneous antenna retraction systems Inadequate

directional control at right sideward velocities between 5 and 15 knots true airspeed was a deficiency Two shortcomings were noted the susceptibility to damage of the right FM 10-120 homing antenna during preflight/maintenance operations and the susceptibility to damage of the FM 10-242 communications antenna during running takeoff/landing maneuvers Author (GRA)

N79-13029// General Dynamics/Convair, San Diego, Calif
BORON/ALUMINUM LANDING GEAR FOR NAVY AIRCRAFT Final Report, Jun. 1974 - Aug. 1977
Sep 1978 129 p refs
(Contract N62269-74-C-0619)
(AD-A058888 CASD-NADC-76-003) Avail NTIS HC A07/MF A01 CSCL 08/13

The program objective was to evaluate the application of boron/aluminum composite material to a typical Navy landing gear component with primary emphasis upon evaluation of component reliability A replacement composite drag link was designed using boron/aluminum tube construction to the required envelope ultimate loads, fatigue spectrum, and carrier environment for the A-7 nose gear lower drag link The resulting composite link design was a 28-ply boron/aluminum tube diffusion bonded to titanium end fittings A test specimen was designed identical to the replacement composite drag link, except that simplified test end fittings replaced the complex flight fittings A comprehensive stress analysis was conducted for both the replacement drag link and the test specimen A finite-element computer analysis of the critical tube/fitting scarf joint was performed Boron/aluminum links that had been damaged by pebble impact then subjected to a corrosive environment and notched showed no reduction in static strength over an as-fabricated specimen and survived two lifetimes at 80% design fatigue load levels This compared favorably with a notched 300M steel production link which failed in fatigue after 11 lifetimes at 70% design fatigue load levels Both the boron/aluminum links and the 300M steel production link were notched and tested in the same sequence GRA

N79-13028// Sikorsky Aircraft, Stratford, Conn
PRELIMINARY DESIGN STUDY OF A TAIL ROTOR BLADE JETTISON CONCEPT Final Report
Robert A Selleck Jul 1978 266 p
(Contract DAAJ02-77-C-0004, DA Proj 1L2-62209-AH-76)
(AD-A059239, SER-70280 USARTL-TR-78-28) Avail NTIS HC A12/MF A01 CSCL 01/3

Loss of a significant portion of a tail rotor blade will cause severe imbalance of the tail rotor that can lead to secondary damage to the helicopter and possible injury to the occupants A system that detects such blade loss and removes the imbalance by jettison of the residual portion of the damaged blade and its opposing blade can overcome the rotor imbalance and allow continued flight Using the performance characteristics of the UH-60A BLACK HAWK helicopter a prototype system was developed and its performance evaluated to determine the capability of the system to jettison rotor blades in a manner that would prevent secondary damage Additionally, analyses were conducted to determine the dynamic stability characteristics of the UH-60A tail rotor in a two-bladed configuration and the ability of the helicopter to accommodate the loads developed during transition from four to two blades Residual helicopter performance and the capability of the helicopter to be retrimmed following jettison of two opposing tail rotor blades was analyzed using the General Helicopter Flight Dynamic Model programmed on a PDP-10 Hybrid Computer GRA

N79-13030// Textron Bell Helicopter Ft Worth, Tex
EFFECT OF OPERATIONAL ENVELOPE LIMITS ON TEETERING ROTOR FLAPPING Final Report, Jun 1976 - Aug 1977
L W Dooley and S W Ferguson, III Jul 1978 94 p refs
(Contract DAAJ02-76-C-0043, DA Proj 1L2-62209-AH-76)
(AD-A059187 USARTL-TR-78-9) Avail NTIS HC A05/MF A01 CSCL 01/3

The objectives of this study were to verify the accuracy of the hybrid computer version of the Rotorcraft Simulation Program C81 as a flapping predictor to investigate the effect of operational envelope limits on flapping and to investigate methods of extending the recommended operational envelopes of the subject helicopter GRA

N79-13032// Rockwell International Corp Los Angeles, Calif
NEW CONCEPTS IN COMPOSITE MATERIAL LANDING GEAR FOR MILITARY AIRCRAFT. VOLUME 1 TECHNICAL DISCUSSION Final Report, Apr 1976 - Feb. 1978
V E Wilson Wright-Patterson AFB, Ohio AFFDL Feb 1978 164 p 2 Vol
(Contract F33615-76-C-3021, AF Proj 2402)
(AD-A058529, AFFDL-TR-78-2-Vol-1) Avail NTIS HC A08/MF A01 CSCL 11/14

Phase 1 effort included the selection of the B-1 Nose Gear as the baseline landing gear system and the conceptual design and evaluation of three concepts using composite material hardware One concept was constrained by form, fit and function, one by fit and function and the third by function only The most effective gains in the use of composite material was when design freedom was increased and only the function constraint was used Phase 2 effort was redirected as a result of the Phase 1 results and the main landing gear for the ATS advanced fighter, which is in the preliminary design stage, was selected as the baseline since it required only the function constraint The scope of materials studied was increased, and Metal Matrix Composites and Advanced Metallics were studied, as well as Organic Advanced Composites Designs were made analyzed, and evaluated for each concept GRA

N79-13033// Rockwell International Corp , Los Angeles, Calif Aircraft Div
NEW CONCEPTS IN COMPOSITE MATERIAL LANDING GEAR FOR MILITARY AIRCRAFT VOLUME 2 APPENDICES Final Report, Apr. 1976 - Feb 1978
V E Wilson Wright-Patterson AFB, Ohio AFFDL Feb 1978 250 p refs 2 Vol
(Contract F33615-76-C-3021, AF Proj 2402)
(AD-A058672, AFFDL-TR-78-2-Vol-2) Avail NTIS HC A11/MF A01 CSCL 11/4

This report describes the effort conducted on Phase 1 of the two-phase Air Force Contract 'New Concepts in Composite Material Landing Gear for Military Aircraft' This Phase 1 section was structured to determine the maximum practical use of composite material for landing gear hardware under three specific sets of constraints GRA

N79-13034// Southwest Research Inst , San Antonio, Tex
DEVELOPMENT OF A BLAST SIMULATOR FOR TESTING SIMULATED AIRCRAFT FUEL TANKS Final Report, Sep. 1976 - Dec 1976
E D Esparza and A B Wenzel Jul 1978 54 p refs
(Contract DAAD05-76-C-0726)
(AD-A058816, SwRI-02-4374, JTCG/AS-76-T-004) Avail NTIS HC A04/MF A01 CSCL 19/4

Anti-aircraft missile warheads pose a severe threat to aircraft even when the missile misses the aircraft The threat from missile warheads can be divided into two primary areas for proximity detonation, fragments and blast This report describes the development, calibration, and testing of a blast simulator capable of varying the blast parameters (i e , pressure, impulse, and time duration) simulating those obtained at various standoff distances from a prototype warhead detonation Author (GRA)

N79-13035// Naval Avionics Center Indianapolis, Ind
REPORT ON MODULAR AVIONIC PACKAGING (MAP) INDUSTRY BRIEFING AND RESPONSE Interim Report
John R Kidwell 9 Aug 1978 182 p
(WF54580000)
(AD-A059193 NAC-TR-2240) Avail NTIS HC A09/MF A01 CSCL 13/4

This report provides information related to a modular avionic packaging (MAP) concept presented to industry on 9 May 1978 at the Naval Avionics Center, Indianapolis, Indiana In attendance

at this meeting were 78 representatives of different divisions of 33 companies As major suppliers of avionics to the Navy, comments provided by these companies were anticipated to be very useful in the further development of packaging approaches for future avionics This report contains the responses provided by industry Although the companies responding are identified by name for reference a reasonable attempt has been made to render the comments anonymous by removing company names and product references The comments have been grouped into categories and summarized, however, no attempt has been made in this report to resolve areas of conflicting opinion given by different companies It is not intended to imply that the Navy or this Center endorses, agrees, or disagrees in any manner with the comments provided by industry Author (GRA)

**N79-13040#** Telcom, Inc Arlington, Va
**ANALYSIS OF THE PROJECTED OPERATIONAL EFFECTIVENESS OF DEVELOPMENTAL WEAPON CONTROL AVIONICS HARDWARE Final Report**
25 Jan 1978 20 p refs
(Contract N00019-77-C-0110)
(AD-A058555) Avail NTIS HC A02/MF A01 CSCL 19/5

This project was in the formative stage throughout most of the period during which TSI carried out its analysis These efforts were tailored toward the VAMX platform which was a conceptual all-weather attack aircraft During the requirements determination phase of this effort, TSI created and presented a briefing on potential VAMX technical and operational problems The principal focus of this briefing was the problems associated with the conduct of close air support/battlefield interdiction in a dense environment such as central Europe There are a number of very complex problems associated with the close air support/battlefield interdiction mission in a dense environment for which there are no solutions currently in hand For instance, there is the problem of the extremely large number of targets and very dense ground-to-air defense environment which is associated with central Europe scenarios GRA

**N79-13041#** Army Aeromedical Research Lab, Fort Rucker, Ala
**HEAD AIMING/TRACKING ACCURACY IN A HELICOPTER ENVIRONMENT**
Robert W Verona May 1978 8 p
(AD-A058444) Avail NTIS HC A03/MF A01 CSCL 01/3

This experiment was conducted to measure man's head aiming/tracking capability using a helmet mounted sighting device The influences of target speed helmet suspension types and helmet weighting parameters on head aiming/tracking were investigated If the aiming/tracking accuracy was sensitive to manipulation of these man-machine interface parameters, then it would seem to indicate that improved aiming/tracking accuracy could be obtained by improving the interface GRA

**N79-13042#** Human Engineering Labs, Aberdeen Proving Ground Md
**HEL PARTICIPATION IN THE PLAN FOR ASSISTING IN THE DEFINITION OF ARMY HELICOPTER ELECTRO-OPTICAL SYMBOLOGY Interim Report**
Andrew T Buckler Jun 1978 53 p refs
(AD-A058730, HEL-TN-1-78) Avail NTIS HC A04/MF A01 CSCL 01/3

This is an interim report on progress made thus far toward optimization of symbology for electro-optical flight displays in Army aircraft The Army aviation community adopted a plan in late 1977 aimed at determining standardization requirements and optimal symbology formats At this time, a literature review, a task analysis and trade-off analysis have been completed while a time-line analysis, information conflict identification, an analysis of flight modes and evaluation criteria development are all in progress This report provides a summary of the program tasks listed above as well as a review of concurrent efforts toward defining symbology for the pilot night vision system in the Advanced Attack Helicopter Author (GRA)

**N79-13043#** Hughes Research Labs, Malibu, Calif
**HOLOGRAPHIC LENS FOR PILOT'S HEAD UP DISPLAY, PHASE 4 Final Report, 25 Mar. 1976 - 25 Mar. 1977**
A Au, A Graube, and L G Cook Aug 1978 66 p refs
(Contract N62269-76-C-0188)
(AD-A058660, NADC-78191-60) Avail NTIS HC A04/MF A01 CSCL 14/5

This report describes work done to design and fabricate a holographic lens for pilot's head up display A holographic head up display (HHUD) trade-off study was done to minimize weight and size of the HHUD This led to a design for a 25 H x 18 V FOV system with a 3 5 in (89 mm) circular exit pupil at an eye relief of 26 in (660 mm) A new design concept was used to reduce the complexity of the relay lens system to a five element asymmetric design Final system optimization reduced typical errors to 2-5 mrad Relayless HHUD and holographic relay lens designs were investigated and found to provide moderate FOV and performance, limited by uncorrected hologram aberrations GRA

**N79-13044*#** National Aeronautics and Space Administration Flight Research Center, Edwards, Calif
**COMPARISON OF CALCULATED AND ALTITUDE-FACILITY-MEASURED THRUST AND AIRFLOW OF TWO PROTOTYPE F100 TURBOFAN ENGINES**
Frank Kurtenbach Dec 1978 29 p refs
(NASA-TP-1373, H-1015) Avail NTIS HC A03/MF A01 CSCL 21E

A comparison is made of the facility performance data for the two engines with an engine performance model, and it provides corrections that can be applied to the model so that it represents the test engines accurately over the flight envelope Test conditions ranged from Mach numbers of 0 80 to 2 00 and altitudes from 4020 meters to 15,240 meters Two distortion screens were used to determine the effect of distortion on airflow Reynolds number effects were also determined Engine hysteresis is documented, as is an attempt to determine engine degradation The calibrated engine model had a twice standard deviation accuracy of approximately 1 24 percent for corrected airflow and 2 38 percent for gross thrust L S

**N79-13045*#** National Aeronautics and Space Administration Hugh L. Dryden Flight Research Center, Edwards, Calif
**MEASUREMENTS AND PREDICTIONS OF FLYOVER AND STATIC NOISE OF A TF30 AFTERBURNING TURBOFAN ENGINE**
Frank W Burcham, Jr, Paul L Lasagna, and Stanley C Oas (Boeing Com Airplane Co) Dec 1978 94 p refs
(NASA-TP-1372, H-1017) Avail NTIS HC A05/MF A01 CSCL 21E

The noise of the TF30 afterburning turbofan engine in an F-111 airplane was determined from static (ground) and flyover tests A survey was made to measure the exhaust temperature and velocity profiles for a range of power settings Comparisons were made between predicted and measured jet mixing, internal, and shock noise It was found that the noise produced at static conditions was dominated by jet mixing noise, and was adequately predicted by current methods The noise produced during flyovers exhibited large contributions from internally generated noise in the forward arc For flyovers with the engine at nonafterburning power, the internal noise, shock noise and jet mixing noise were accurately predicted During flyovers with afterburning power settings, however, additional internal noise believed to be due to the afterburning process was evident, its level was as much as 8 decibels above the nonafterburning internal noise Power settings that produced exhausts with inverted velocity profiles appeared to be slightly less noisy than power settings of equal thrust that produced uniform exhaust velocity profiles both in flight and in static testing B B

**N79-13046*#** National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
**LOW-CYCLE FATIGUE OF THERMAL-BARRIER COATINGS AT 982 DEG C**

Albert Kaufman, Curt H Liebert, and Alfred J Nachtigall Dec 1978 20 p refs
(NASA-TP-1322, E-9688) Avail NTIS HC A02/MF A01 CSCL 21E

The low-cycle fatigue lives of ZrO2-NiCrAlY and Al2O3-ZrO2-NiCrAlY thermal-barrier coatings in air at 982 C were determined from cyclic flexural tests of coated TAZ-8A strips Strains were computed as a function of specimen displacements from a nonlinear, three-dimensional stress analysis program Fatigue resistances of thermal-barrier coatings applied to the strips were compared with those of uncoated and NiCrAlY-coated strips The results indicate that ZrO2 is about four times greater in fatigue life than TAZ-8A at 982 C that ZrO2 would probably retain that fatigue strength up to 1316 C and that adding an outer coat of Al2O3 to ZrO2 is neither beneficial nor detrimental to fatigue resistance Author

N79-13047*# Borst (Henry V) and Associates, Wayne, Pa
A NEW BLADE ELEMENT METHOD FOR CALCULATING THE PERFORMANCE OF HIGH AND INTERMEDIATE SOLIDITY AXIAL FLOW FANS
Henry V Borst Nov 1978 51 p refs
(Contract NAS2-9079)
(NASA-CR-3063) Avail NTIS HC A04/MF A01 CSCL 21E

A method is presented to design and predict the performance of axial flow rotors operating in a duct The same method is suitable for the design of ducted fans and open propellers The unified method is based on the blade element approach and the vortex theory for determining the three dimensional effects, so that two dimensional airfoil data can be used for determining the resultant force on each blade element Resolution of this force in the thrust and torque planes and integration allows the total performance of the rotor, fan or propeller to be predicted Three different methods of analysis, one based on a momentum flow theory, another on the vortex theory of propellers, and a third based on the theory of ducted fans agree and reduce cascade airfoil data to single line as a function of the loading and induced angle of attack at values of constant inflow angle The theory applies for any solidity from 01 to over 1 and any blade section camber The effects of the duct and blade number can be determined so that the procedure applies over the entire range from two blade open propellers to ducted helicopter tail rotors, to axial flow compressors with or without guide vanes, and to wind tunnel drive fans Author

N79-13048*# General Electric Co, Cincinnati, Ohio Aircraft Engine Group
DEFINITION STUDY FOR VARIABLE CYCLE ENGINE TESTBED ENGINE AND ASSOCIATED TEST PROGRAM Final Report
John W Vdoviak Nov 1978 112 p
(Contract NAS3-20582A)
(NASA-CR-159459, R78AEG551) Avail NTIS HC A06/MF A01 CSCL 21E

The product/study double bypass variable cycle engine (VCE) was updated to incorporate recent improvements The effect of these improvements on mission range and noise levels was determined This engine design was then compared with current existing high-technology core engines in order to define a subscale testbed configuration that simulated many of the critical technology features of the product/study VCE Detailed preliminary program plans were then developed for the design fabrication and static test of the selected testbed engine configuration These plans included estimated costs and schedules for the detail design, fabrication and test of the testbed engine and the definition of a test program, test plan, schedule, instrumentation, and test stand requirements Author

N79-13049*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
COLD-AIR PERFORMANCE OF FREE POWER TURBINE DESIGNED FOR 112-KILOWATT AUTOMOTIVE GAS-TURBINE ENGINE 3: EFFECT OF STATOR VANE END CLEARANCES ON PERFORMANCE
Milton G Kofskey and Kerry L McLallin Dec 1978 41 p refs
(Contract EC-77-A-31-1011)
(NASA-TM-78956 DOE/NASA/1011-78/29) Avail NTIS HC A03/MF A01 CSCL 21A

An experimental investigation of a free power turbine designed for a 112-kW automotive gas turbine engine was made to determine the penalty in performance due to the stator vane end clearances Tests were made over a range of mean section stator vane angles from 26 deg to 50 deg (as measured from the plane of rotation) with the vane end clearances filled These results were compared with test results of the same turbine with vane end clearances open At design equivalent values of rotative speed and pressure ratio and at a vane angle of 35 deg, the mass flow with the vane end clearances filled was about 8 percent lower than mass flow with vane end clearances open The decrease in mass flow was mitigated by increasing the vane angle With the vane end clearances filled there was about a 66 percent reduction in mass flow when the vane angle was decreased from 40 deg to 26 deg For the same decrease in vane angle the stator throat area decreased by about 50 percent This result indicates that the rotor losses were increasing with decreasing vane angle B B

N79-13050*# Pratt and Whitney Aircraft Group, East Hartford, Conn Commercial Products Div
ANALYTICAL EVALUATION OF THE IMPACT OF BROAD SPECIFICATION FUELS ON HIGH BYPASS TURBOFAN ENGINE COMBUSTORS Final Report
R P Lohmann, E J Szetela, and A Vranos Dec 1978 161 p refs
(Contract NAS3-20802)
(NASA-CR-159454 PWA-5565-15) Avail NTIS HC A08/MF A01 CSCL 21E

The impact of the use of broad specification fuels on the design, performance durability emissions and operational characteristics of combustors for commercial aircraft gas turbine engines was assessed Single stage vorbix and lean premixed prevaporized combustors, in the JT9D and an advanced energy efficient engine cycle were evaluated when operating on Jet A and ERBS (Experimental Referee Broad Specification) fuels Design modifications based on criteria evolved from a literature survey, were introduced and their effectiveness at offsetting projected deficiencies resulting from the use of ERBS was estimated The results indicate that the use of a broad specification fuel such as ERBS, will necessitate significant technology improvements and redesign if deteriorated performance, durability and emissions are to be avoided Higher radiant heat loads are projected to seriously compromise liner life while the reduced thermal stability of ERBS will require revisions to the engine-airframe fuel system to reduce the thermal stress on the fuel Smoke and emissions output are projected to increase with the use of broad specification fuels While the basic geometry of the single stage and vorbix combustors are compatible with the use of ERBS, extensive redesign of the front end of the lean premixed prevaporized burner will be required to achieve satisfactory operation and optimum emissions G G

N79-13051*# AiResearch Mfg Co, Phoenix Ariz
VARIABLE GEOMETRY TORQUE CONVERTER Final Report, Mar 1970 - Nov. 1977
K W Benn and G L Perrone 10 Apr 1978 159 p
(Contract F33615-76-C-2013, AF Proj 3145)
(AD-A058603, AiResearch-31-2775A, AFAPL-TR-78-18) Avail NTIS HC A08/MF A01 CSCL 10/2

Program objective was to design and evaluate a breadboard variable reactor system using the B-1 secondary power system torque converter Results of the evaluation indicate that a variable reactor can be used in a small, high-speed torque converter to control input and output power schedules during an acceleration between speed ratios from zero to approximately 0 9 GRA

N79-13052*# Purdue Univ, Lafayette Ind School of Aeronautics and Astronautics
ANALYSIS OF WATER INGESTION EFFECTS IN AXIAL FLOW COMPRESSORS Final Report, 1 Sep 1970 - Nov 1977

S N B Murphy, B A Reese, G T Arcangeli, and T Tsuchiya Jun 1978 99 p refs
(Contract F33615-74-C-2014, AF Proj 3048)
(AD-A059025, M-WPAFB-T-76-1, AFAPL-TR-78-35) Avail NTIS HC A05/MF A01 CSCL 13/7

In the study of the general problem of predicting performance and instability of installed jet engines during water ingestion (deliberate or accidental), the establishment of the behavior of the compressor in an engine is an important task In continuation of an earlier study, this report includes (1) analysis of selected compressors with water ingestion and evaporation, (2) effect of bleed and/or injection, and (3) further development of a two-phase model with three droplet sizes for calculating compressor performance An important result of investigations on selected compressors is the crucial influence of the location of water evaporation in the compressor and the blade loading A second significant outcome of the investigations is that in order to simulate the engine with two-phase flow component responses are required in great detail Author (GRA)

N79-13035# Systems Control, Inc, Palo Alto Calif
ADVANCED FAULT DETECTION AND ISOLATION METHODS FOR AIRCRAFT TURBINE ENGINES Engineering Technical Report, 1 Jan 1976 - 1 May 1977
Ronald L DeHoff and W Earl Hall, Jr 1 Feb 1978 95 p refs
(Contract N00014-76-C-0420)
(AD-A058891, ONR-CR215-245-1) Avail NTIS HC A05/MF A01 CSCL 21/5

Aircraft engine diagnostic methods are reviewed The role of computer-aided diagnostic procedures for current and future engines is discussed from the aspects of performance monitoring, trending, and fault detection/isolation Development of advanced maximum likelihood or regression algorithms for each of these is presented A methodology is developed for applying these algorithms to models derived from engine test stand or flight data Specific computational results are given for a high performance turbofan engine Author (GRA)

N79-13054# Cornell Univ, Ithaca, N Y
RESEARCH ON HELICOPTER ROTOR NOISE Final Report, 1 Mar 1975 - 15 Jun 1978
A R George 15 Aug 1978 19 p refs
(Grant DAHC04-75-G-0120)
(AD-A058388, ARO-12718 1-E) Avail NTIS HC A02/MF A01 CSCL 20/1

Research was conducted on aspect of noise generation by helicopters A general review of helicopter noise was prepared and published as one part of the work Methods were developed for the analysis of high frequency broadband noise from rotors Physical and analytical approximations were devised which allow practical calculation of noise from various loading mechanisms Atmospheric turbulence noise was investigated including some effects of inflow distribution A method for predicting trailing edge noise for rotors was developed The results show that trailing edge noise can be quite important at high frequencies when the small scale components of ingested turbulence are weak compared to those of the blade boundary layer turbulence In the area of high speed noise from high Mach number advancing blades the research was primarily concentrated on the radiated sound from the Lighthill stress associated with the occurrence of unsteady shock formation and disappearance on advancing transonic rotor blades A simplified model of an impulsively started and stopped shock was used as the known near field in order to find the far field radiation Author (GRA)

N79-13036*# Franklin Research Center, Philadelphia, Pa
DESIGN AND TEST OF THE 172K FLUIDIC RUDDER Final Report, Apr 1977 - Oct 1978
Charles A Belsterling Oct 1978 44 p refs
(Contract NAS1-14893)
(NASA-CR-158974, F-C4705) Avail NTIS HC A03/MF A01 CSCL 01C

Progress in the development of concepts for control of aircraft without moving parts or a separate source of power is described The design and wind tunnel tests of a full scale fluidic rudder for a Cessna 172K aircraft, intended for subsequent flight tests were documented The 172K fluidic rudder was designed to provide a control force equivalent to 3 3 degrees of deflection of the conventional rudder In spite of an extremely thin airfoil, cascaded fluidic amplifiers were built to fit, with the capacity for generating the required level of control force Wind tunnel tests demonstrated that the principles of lift control using ram air power are sound and reliable under all flight conditions The tests also demonstrated that the performance of the 172K fluidic rudder is not acceptable for flight tests until the design of the scoop is modified to prevent interference with the lift control phenomenon B B

N79-13037*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center, Edwards, Calif
FLIGHT COMPARISON OF THE TRANSONIC AGILITY OF THE F-111A AIRPLANE AND THE F-111 SUPERCRITICAL WING AIRPLANE
Edward L Friend and Glenn M Sakamoto Dec 1978 78 p refs
(NASA-TP-1368, H-985) Avail NTIS HC A05/MF A01 CSCL 01C

A flight research program was conducted to investigate the improvements in maneuverability of an F-111A airplane equipped with a supercritical wing In this configuration the aircraft is known as the F-111 TACT (transonic aircraft technology) airplane The variable-wing-sweep feature permitted an evaluation of the supercritical wing in many configurations The primary emphasis was placed on the transonic Mach number region, which is considered to be the principal air combat arena for fighter aircraft An agility study was undertaken to assess the maneuverability of the F-111A aircraft with a supercritical wing at both design and off-design conditions The evaluation included an assessment of aerodynamic and maneuver performance in conjunction with an evaluation of precision controllability during tailchase gunsight tracking tasks Author

N79-13037*# National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
A NONLINEAR TRAJECTORY COMMAND GENERATOR FOR A DIGITAL FLIGHT-CONTROL SYSTEM
Luigi S Cicolani and Stein Weissenberger Nov 1978 114 p refs
(NASA-TP-1221 A-7074) Avail NTIS HC A06/MF A01 CSCL 01C

Operational application of the command generator (CG) was examined in detail in a simulation of a flight control system with the augmentor wing jet STOL research aircraft The basic repertoire of single axis maneuvers and operational constraints are discussed, and the system behavior is tested on a rigorous STOL approach path and as affected by various approximations in the CG synthesis and types of disturbances found in the operational environment The simulation results indicate that a satisfactory nonlinear system with general maneuvering capabilities throughout the flight envelope was developed which satisfies the basic design objectives while maintaining a practicable degree of simplicity Author

N79-13038# Honeywell, Inc, St Louis Park, Minn Avionics Div
INVESTIGATION OF A LOW-COST SERVOACTUATOR FOR HYSAS Final Report, Apr 1977 - Mar 1978
James O Hedeen Jul 1978 88 p
(Contract DAAJ02-77-C-0025, DA Proj 1L1-62114-AH-73)
(AD-A059188, HONEYWELL-W0597-FR, USARTL-TR-78-30) Avail NTIS HC A05/MF A01 CSCL 13/9

This document covers the design and testing of a fluidic input servoactuator to perform the series servoactuator function in a helicopter hydrofluidic stability augmentation system (HYSAS) The servoactuator consists of a two-stage fluidic amplifier cascade driving a conventional spool valve that positions a spring-centered cylinder Simplicity and minimum cost commensurate with essential servoactuator performance was the design goal A breadboard model servoactuator was designed, fabricated, and bench tested to evaluate feasibility Servoactuator performance

objectives were met at nominal supply conditions, but not over the complete operational oil temperature range Author (GRA)

N79-13065# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
STABILIZATION TECHNIQUES FOR IMPROVED RESPONSE OF THE F-16 AIRCRAFT M.S. Thesis
Steven Lew Whitemarsh Jun 1978 160 p refs
(AD-A058514, AFIT/GGC/EE/78-6) Avail NTIS HC A08/MF A01 CSCL 01/1

The purpose of this study was to show that by moving an aircraft s center-of-gravity aft of the aerodynamic neutral point, thus making it statically unstable, the use of a feedback control system produces a more responsive stable aircraft Pitch rate, normal acceleration and angle-of-attack rate were used as the feedback parameters in a pitch orientational control system having two feedback loops The inner loop was used to improve the dynamic response characteristics and the outer loop to stabilize the aircraft While all three types of feedback control were able to improve the aircraft response, the pitch rate feedback system had the least response variation between five different flight test conditions and provided the best overall system improvement Author (GRA)

N79-13066*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
DESCRIPTION AND PRELIMINARY CALIBRATION RESULTS FOR THE LANGLEY HYPERSONIC CF4 TUNNEL
R E Midden and C G Miller Nov 1978 48 p refs
(NASA-TM-78800) Avail NTIS HC A03/MF A01 CSCL 14B

A detailed description of the hypersonic CF4 tunnel is presented along with discussion of the basic components, instrumentation, and operating procedure Operational experience with the CF4 reclaimer and lead-bath heater is discussed Comparison of measured and predicted shock detachment distance on a sphere and pressure distributions measured on a sharp leading-edge flat plate revealed the absence of significant flow nonuniformity and lent creditability to predicted free stream flow conditions The economic operation of this facility centers about the CF4 reclaimer, which was designed to operate at an efficiency of 90 to 95 percent A number of modifications were made to the reclaimer system to improve its performance, and presently, the system reclaims approximately 75 percent of the test gas Even with current budgetary constraints, this efficiency permits the CF4 tunnel to be operated as a viable research wind tunnel G G

N79-13067# Royal Aircraft Establishment, Bedford (England)
THE USE OF SOUND ABSORBING WALLS TO REDUCE DYNAMIC INTERFERENCE IN WIND TUNNELS
Dennis G Mabey 30 Mar 1978 41 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Mar 1979
Avail NTIS HC A03/MF A01

A scheme for reducing dynamic interference at subsonic and transonic speeds was tested in two wind tunnels Two types of dynamic interference were considered excitation of unwanted acoustic resonances within the working section, and flow unsteadiness The tests showed that both types of interference could be substantially reduced by replacing the conventional hard walls of a closed or a slotted working section by appropriate sound absorbing walls The models used to establish the resonances in the working sections with hard walls were circular cylinders operating in the subcritical Reynolds number range (R sub d is less than 200 000) and thus generating discrete pressure fluctuations at the vortex shedding frequency When the resonances were suppressed by the wall material the pressure fluctuations agreed well with previous measurements made in a much larger, low speed wind tunnel, and with predictions The investigation in the larger tunnel also showed the superiority of sound absorbing walls for buffeting measurements Author

N79-13068# Naval Air Test Center, Patuxent River, Md.
A PROGRAM FOR DETERMINING FLIGHT SIMULATOR FIELD-OF-VIEW REQUIREMENTS
R Yeend and D Canco 13 Sep 1978 13 p refs
(AD-A058932, NATC-TM-78-1RW) Avail NTIS HC A02/MF A02 CSCL 09/2

This memorandum discusses a test approach for determining the optimum field-of-view of a flight simulator visual system as a function of aircraft mission The program is intended to provide the information needed to decide which portions of the aircraft's total field-of-view should be simulated and which can be disregarded The approach consists of three phases, drawing board evaluation, aircraft ground testing, and flight testing The procedure is described using the CH-46 helicopter as an illustrative example but it is applicable directly to any aircraft, fixed or rotary wing Pilot qualitative ratings are obtained for each simulated visual configuration during specified flight maneuvers GRA

N79-13069*# Naval Research Lab, Washington, D C
COMPARATIVE NOZZLE STUDY FOR APPLYING AQUEOUS FILM FORMING FOAM ON LARGE-SCALE FIRES Final Report, Nov. 1976 - Sep 1977
Edwin J Jablonski Tyndall AFB, Fla Civil and Environ Eng Develop Office Apr 1978 45 p refs
(AFCEC Proj 77-018)
(AD-A058562, NRL-6180-157-EJJ-NJS, CEEDO-TR-78-22)
Avail NTIS HC A03/MF A01 CSCL 13/12

A large-scale fire test program was conducted to evaluate the relative fire-fighting effectiveness of applying aqueous film forming foams (AFFF) through commercially available air-aspirating and non air-aspirating nozzles The Navy MB-1 and P-4A and Air Force P-4 aircraft fire-rescue vehicles were used as nozzle test-beds Nozzles with rated capacities of 250 gpm and 750 to 800 gpm were tested and evaluated on 4000 square feet and 8000 square feet JP-4 fuel fires, respectively Eight of the 16 fires conducted contained an aircraft mock-up The lower expansion, more fluid, longer reach aqueous film forming foams generated with the non air-aspirating type nozzles were found to provide superior fire extinguishing effectiveness compared to the air-aspirating type nozzles Air-aspirated foams required approximately 50 percent longer to achieve 90 percent fire control than the non air-aspirated foams No discernible difference in burnback resistance was found for either type of foam Author (GRA)

N79-13070# Naval Air Development Center, Warminster, Pa Systems Directorate
INVESTIGATION OF MOTION BASE DRIVE TECHNIQUES
M E Bitner 3 Mar 1978 153 p refs
(AD-A053830, NADC-77306-20) Avail NTIS HC A08/MF A01 CSCL 05/9

Motion base drive functions required for simulating helicopter and V/STOL aircraft were investigated, developed and evaluated on the NAVAIRDEVCEN three degree of freedom motion base Author (GRA)

N79-13071# Air Force Human Resources Lab, Brooks AFB, Tex
CONTRIBUTIONS OF PLATFORM MOTION TO SIMULATOR TRAINING EFFECTIVENESS. STUDY 1 BASIC CONTACT Interim Report, Mar 1976 - Nov. 1977
Elizabeth L Martin and Wayne L Waag Jun 1978 39 p refs
(AF Proj 1123)
(AD-A058416, AFHRL-TR-78-15) Avail NTIS HC A03/MF A01 CSCL 05/9

A transfer-of-training design was used to evaluate the contributions of simulator training with a synergistic six-degree-of-freedom platform motion system to the acquisition of basic contact, approach and landing skills Twenty-four Undergraduate Pilot Trainees were divided into three groups (1) Motion, (2) No Motion, and (3) Control The Motion and No-Motion groups received ten instructional sorties in the Advanced Simulator for Pilot Training (ASPT) on a large number of basic contact tasks ranging in complexity from Straight-and-Level to the normal Overhead Pattern and Traffic Pattern Stalls Both groups received the same amount of training on each task All tasks were taught

using the full field-of-view available on the ASPT's computer-generated image visual system The students in the Control group received the standard pre-flight training (i e , no ASPT pretraining) Student performance during the simulator training phase was assessed by Instructor Pilot ratings of task performance and automated objective performance measures The major findings of the study are (1) no differences in simulator performance between the Motion and No-Motion groups (2) significant learning occurred during simulator training for both groups, (3) no difference in performance between the Motion and No-Motion groups for any of the tasks on the two special data sorties flown in the T-37 GRA

N79-13097# Army Engineer Waterways Experiment Station, Vicksburg, Miss
NONDESTRUCTIVE EVALUATION PROCEDURE FOR MILITARY AIRFIELDS Final Report, 1 Jul. - 30 Sep 1976
Jim W Hall, Jr Jul 1978 87 p refs
(AD-A058736, WES-MP-S-78-7) Avail NTIS HC A05/MF A01 CSCL 01/5

This report presents a procedure for the nondestructive evaluation of military airfield pavements Nondestructive testing is performed with a 16 kip electrohydraulic vibrator which measures the load-deflection response of pavements, and the results are reported as dynamic stiffness modulus (DSM) Correlations of the DSM to allowable single-wheel load are used with existing analytical relationships to give the allowable gross aircraft loads and required overlay thicknesses The procedures described are based on findings from earlier research studies that are referenced Testing techniques, data reduction procedures computational methodology, and detailed examples were developed to satisfy the need for a rapid nondestructive test procedure Author (GRA)

N79-13098# Sandia Labs Livermore, Calif
FLIGHT DYNAMICS LABORATORY AT SLL
R G Marmon May 1978 58 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8240) Avail NTIS HC A04/MF A01

Missile flight mechanics are in multi-degree-of-freedom motion (simulated in real time) on the hybrid equipment Guidance and control hardware can be mounted on the Carco device and subjected to the angular rates and displacements encountered in full-scale flight In addition to flight simulation, the hybrid computer can be used effectively for solution of a variety of engineering and scientific problems involving ordinary differential equations and, in some cases, partial differential equations A general description of the FDL is given, some software that is available is described and some past uses are summarized DOE

N79-13099# Honeywell, Inc , Minneapolis, Minn Avionics Div
COMPOSITE GIMBAL MATERIALS STUDY Final Report, Jan. - Oct. 1977
L V Grandchamp, R P Grosso, and T O Rue May 1978 76 p
(Contract DAAG46-77-C-0011, DA Proj 1L1-63102-D-071)
(AD-A059089, AMMRC-TR-78-25) Avail NTIS HC A05/MF A01 CSCL 11/4

This report describes a study of composite materials for fabrication of structural elements in airborne gimballed optical systems The particular system studied was the Pointing and Stabilization Element (POISE) gimballed platform as used for fire control and surveillance applications, and carried on remotely piloted vehicles (RPV) It was determined that the magnesium castings used for the two gimbals as well as the mounting base plate could be replaced with graphite-epoxy moldings, using a sandwich structure approach, with a foam core or an aluminum honeycomb core Specific stiffness was found to be 3-5 times higher than magnesium, even when using sandwich structure This results in a structural element of the same shape and size as the magnesium but which will be significantly lighter, while still being significantly stiffer, and projected to be less expensive A fabrication process was conceived and proved out permitting molding of complex precision shapes, utilizing simple and low cost tooling Author (GRA)

N79-13100# Naval Air Propulsion Test Center, Trenton, N J Propulsion Technology and Project Engineering Dept
PERFORMANCE OF HOT FUEL IN A SINGLE TUBE HEAT EXCHANGER TEST RIG Final Report
Raymond J Delfosse Aug 1978 31 p ref
(AD-A058744, NAPC-PE-11) Avail NTIS HC A03/MF A01 CSCL 21/4

A single tube heat exchanger test rig was utilized to establish the effects of fuel heating upon fuel degradation Fuel degradation effects were determined by weighing fuel deposits within the heat exchanger tube and measuring the change in heat exchanger effectiveness ratio Fuels of varying thermal oxidative stability characteristics were tested and a relationship was developed between those characteristics and the performance of the fuels in the heat exchanger rig Author (GRA)

N79-13102# Advisory Group for Aerospace Research and Development, Paris (France)
AIRCRAFT ENGINE FUTURE FUELS AND ENERGY CONSERVATION
Sep 1978 188 p refs Lecture Series held at Munich, 16-17 Oct 1978 and London, 19-20 Oct 1978
(AGARD-LS-96, ISBN-92-835-1297-9) Avail NTIS HC A09/MF A01

Current and forecasted world energy demands, growth, and supply are reviewed in perspective to the status and outlook for future aviation fuels to meet NATO needs The special problems associated with the refining of aviation fuels from lower quality feedstocks (including fuel refined from coal oil shale and tar sands) and techniques for reducing energy consumption in refining processes are examined Special attention is given to the chemistry and combustion characteristics of future hydrocarbon fuels and the impact of using these fuels in aircraft engines and fuel systems An assessment is made as to what technology advancements are currently underway and what other advancements are needed with reference to engine components engine systems, aircraft designs and operational procedures to help conserve fuel resources

N79-13103# Imperial Coll of Science and Technology, London (England) Dept of Mechanical Engineering
FUTURE FUELS FOR AVIATION
J J MacFarlane *In* AGARD Aircraft Eng Future Fuels and Energy Conserv Sep 1978 12 p refs

Avail NTIS HC A09/MF A01

The historical background of the current aviation gas turbine fuel specification is described Current local supply difficulties are discussed in relation to crude oil availability and the pattern of regional demand for petroleum products The consensus of expert opinion on the effects of predicted future petroleum resource availability and of various trade and economic factors on future rates of production are described Recent data on the demand for petroleum products and the crucial importance of future demand control are discussed The prospects for petroleum based aviation fuel are evaluated The long term sources of aviation fuel are described and the problem areas enumerated The need for a research program on alternative fuels is demonstrated Previous work using model flames on the effects of fuel composition on rich flame chemistry is reviewed and the potential contribution of fundamental research in the alternative aviation fuels program is outlined J M S

N79-13104# Shell Research Ltd , Chester (England) Thornton Research Centre
FUTURE AVIATION FUELS FUEL SUPPLIERS VIEWS
A Lewis *In* AGARD Aircraft Eng Future Fuels and Energy Conserv Sep 1978 22 p refs

Avail NTIS HC A09/MF A01

Developments in the potential future availability of aviation fuels from petroleum crude oils, shale oils, and coal are reviewed on the basis of published data Much of the data were derived from statistics of the Organization for Economic Cooperation and Development and the Workshop on Alternative Energy Strategies J M S

N79-13103# Imperial Coll of Science and Technology, London (England) Dept of Mechanical Engineering
THE ROLE OF FUNDAMENTAL COMBUSTION IN THE FUTURE AVIATION FUELS PROGRAM
J J MacFarlane *In* AGARD Aircraft Eng Future Fuels and Energy Conserv Sep 1978 6 p refs

Avail NTIS HC A09/MF A01

Alternative fuels research using can type engine combustors is briefly summarized This research stressed the overall response of the system to fairly arbitrary changes in fuel properties and fuel preparation observing such quantities as carbon deposit formation wall temperature, combustor outlet temperature distribution, and combustion efficiency Flame research undertaken to study the way in which carbon is formed in gas turbine primary zones was described This research utilized experimental model combustors, prevaporized and premixed C5 and C6 hydrocarbons and kerosene, and sprayed kerosene Contour maps of soot formation as a function of pressure and equivalence ratios were presented The mechanism of carbon formation in spray flames was discussed J M S

N79-13104*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
CHARACTERISTICS AND COMBUSTION OF FUTURE HYDROCARBON FUELS
R A Rudey and J S Grobman *In* AGARD Aircraft Eng Future Fuels and Energy Conserv Sep 1978 23 p refs

Avail NTIS HC A09/MF A01 CSCL 21D

Changes in fuel properties that are expected in future hydrocarbon fuels for aircraft are discussed along with the principal properties of 'syncrudes' and the fuels that can be derived from them The impact that the resultant potential changes in fuel properties may have on combustion and thermal stability characteristics is illustrated and discussed in terms of ignition, soot formation, carbon deposition, flame radiation, and emissions J M S

N79-13107*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
IMPACT OF FUTURE FUEL PROPERTIES ON AIRCRAFT ENGINES AND FUEL SYSTEMS
R A Rudey and J S Grobman *In* AGARD Aircraft Eng Future Fuels and Energy Conserv Sep 1978 29 p refs

Avail NTIS HC A09/MF A01 CSCL 21D

The effect of modifications in hydrocarbon jet fuels specifications on engine performance, component durability and maintenance, and aircraft fuel system performance is discussed Specific topics covered include specific fuel consumption, ignition at relight limits exhaust emissions, combustor liner temperatures, carbon deposition gum formation in fuel nozzles, erosion and corrosion of turbine blades and vanes, deposits in fuel system heat exchangers, and pumpability and flowability of the fuel Data that evaluate the ability of current technology aircraft to accept fuel specification changes are presented, and selected technological advances that can reduce the severity of the problems are described and discussed J M S

N79-13105# Pratt and Whitney Aircraft Group, East Hartford, Conn
ENGINE COMPONENT IMPROVEMENT AND PERFORMANCE RETENTION
William H Sens *In* AGARD Aircraft Eng Future Fuels and Energy Conserv Sep 1978 12 p

Avail NTIS HC A09/MF A01

The importance of improving the fuel consumption of current engines and their derivatives is addressed in terms of making significant savings in aircraft fuel consumption in this century Methods of reducing fuel consumption of current engines considered include (1) cycle improvement incorporated in growth and derivative engine models by changes in bypass ratio, overall pressure ratio, and turbine inlet temperature, (2) component performance improvements through design refinements incorporated into the existing engines during routine overhaul, and (3) improved engine performance retention through revised maintenance procedures and improved design J M S

N79-13106# Pratt and Whitney Aircraft Group, East Hartford, Conn
LOW ENERGY CONSUMPTION ENGINES
William H Sens *In* AGARD Aircraft Eng Future Fuels and Energy Conserv Sep 1978 13 p refs

Avail NTIS HC A09/MF A01

Improvements in aircraft gas turbine engine economy over four decades are briefly reviewed Possibilities for the evolution of the turbofan cycle to give improved engine performance are discussed with emphasis on the Energy Efficient Engine Program Alternative cycles are also considered These include Brayton cycle, regenerative cycle, compound, fan, shrouded propeller, and the prop-fan The prop-fan is considered the most promising J M S

N79-13200# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)
ENERGY CONSERVATION AIRCRAFT DESIGN AND OPERATIONAL PROCEDURES
Philippe Poisson-Quinton *In* AGARD Aircraft Eng Future Fuels and Energy Conserv Sep 1978 47 p refs

Avail NTIS HC A09/MF A01

A review is given of studies and applications leading to improved fuel efficiency in the air transportation system Major technological progress in aerodynamics, structures/materials, propulsion integration, and avionics is quantified for the subsonic transport aircraft as well as future VTOL, STOL, and SST It is shown that improvements on flight and ground operational procedures are in the developmental stage and that these improvements must strongly reduce the energy waste of the current civil and military air transportation system J M S

N79-13202# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla Detachment 1 ADTC
AN INVESTIGATION INTO THE USE OF POLYMER-CONCRETE FOR RAPID REPAIR OF AIRFIELD PAVEMENTS M.S. Thesis. Final Report, Jun. - Dec. 1977
Michael T McNarney Jan 1978 127 p refs
(AF Proj 2104)
(AD-A059121, CEEDO-TR-78-10) Avail NTIS HC A07/MF A01 CSCL 01/5

An investigation of a high-strength fast setting mixture of methyl methacrylate and dry aggregate was conducted The resulting polymer-concrete (PC) was very strong, durable, and bonded excellently to concrete Tests were conducted to determine the variables affecting the polymerization time and strength of polymer-concrete Field tests were conducted to interstate highways and a major airport taxiway which demonstrated the feasibility of making rapid polymer-concrete repairs at a reasonable cost Laboratory tests of a 3-foot by 6-foot area repaired by PC and an individual PC slab under repeated loadings of simulated truck and aircraft traffic demonstrated the excellent strength and durability of the material A cost analysis found the cost of monomer to be approximately $10/cubic foot for most repairs Author (GRA)

N79-13233# Naval Surface Weapons Center, White Oak, Md
IN-HOUSE EXPLORATORY DEVELOPMENT PROGRAM ON MICROSTRIP ANTENNAS Final Report
J N McCordle and L M Black 28 Feb 1978 63 p refs
(ZF61112001)
(AD-A058899, NSWC/WOL/TR-76-69) Avail NTIS HC A04/MF A01 CSCL 09/5

This report describes some of the basic forms of the microstrip patch antenna and gives a general theory of operation It then goes into the derivation of a previously unpublished design procedure for the rectangular patch radiator The computer aided design procedure is explained in detail Author (GRA)

N79-13235# Defence Research Establishment Ottawa (Ontario) Defence Electronics Section
TRACKER ANTENNA LOCATION STUDY
J Glen Rumbold Jul 1978 117 p refs
(AD-A059026, DREO-TN-78-4) Avail NTIS HC A06/MF A01 CSCL 17/9

This report details the antenna location study for the Tracker Aircraft refitment Computer prediction of electromagnetic interference and antenna coupling in conjunction with antenna pattern measurements made on a scale model of the Tracker yielded suggested locations for the new antennas Author (GRA)

N79-13241# Ohio State Univ , Columbus Electroscience Lab
A HYBRID TECHNIQUE FOR COMBINING THE MOMENT METHOD TREATMENT OF WIRE ANTENNAS WITH THE GTD FOR CURVED SURFACES
Ernest P Ekelman Jr and Gary A Thiele Jul 1978 132 p refs
(Contract N00014-76-C-0573)
(AD-A058495 ESL-784372-5) Avail NTIS HC A07/MF A01 CSCL 09/5

The hybrid technique presented in this paper is a method for solving electromagnetic problems in which an antenna or other discontinuity is located on or near a conducting body, such as antennas on ships or aircraft The technique solves these kinds of problems by properly analyzing the interaction between the antenna or scatterer and the conducting body The hybrid technique accomplishes this by casting the antenna structure in a moment method format then modifying that format to account for the effects of the conducting body via the geometrical theory of diffraction The technique extends the moment method to handle many problems that cannot be solved by GTD or the moment method alone In general, arbitrary radiators located on or near canonical shapes or combinations thereof can be solved using the hybrid technique Electromagnetic parameters for which the hybrid technique can solve include the near and far fields, current distributions, impedances and scattering data In this paper wire antennas are analyzed to find their input impedance when they are located near perfectly-conducting circular cylinders The purpose of this paper is to present the technique and demonstrate some of its facility and its accuracy GRA

N79-13247# Air Force Academy Colo
PERFORMANCE OF GRAPHITE EPOXY AS AN ANTENNA GROUND PLANE Final Report
John E Erickson and Oscar D Graham Aug 1978 63 p refs
(AD-A058346 USAFA-TR-78-4) Avail NTIS HC A04/MF A01 CSCL 09/5

This final report describes work undertaken by members of the Department of Electrical Engineering at the USAF Academy Colorado for the Post Doctoral Program/Rome Air Development Center/Griffiss AFB, N Y This effort involved a study of graphite epoxy composite material as an antenna ground plane at the frequencies of 370 and 837 MHz Five by five foot sheets of graphite epoxy were provided by the Composites Laboratory of the Air Force Flight Dynamics Laboratory at Wright-Patterson AFB Antenna impedance and antenna pattern measurements were made using these graphite epoxy sheets and also an identically sized sheet of aluminum These measurements were made with both monopole and dipole antennas and also with a UHF blade antenna from an F4 aircraft Results show that the 50 ply sheet of graphite epoxy behaves identically with an aluminum ground plane when used with a monopole or dipole receiving antenna at 370 and 837 MHz
Author (GRA)

N79-13319 Tennessee Univ , Knoxville
A FINITE ELEMENT APPROACH TO THE PROBLEM OF SOUND PROPAGATION AND ATTENUATION IN JET ENGINE AIR INTAKES Ph D Thesis
Ismail Abdelrahman Tag 1978 239 p
Avail Univ Microfilms Order No 7823354

The general nonlinear three-dimensional equation for the acoustic velocity potential is derived by using a perturbation technique The nonlinear three-dimensional equation is then linearized and solved using a finite element algorithm based on Galerkin formulation for a harmonic time dependence The solution is carried out in complex number notation for the acoustic velocity potential Sound pressure levels and acoustic velocities are calculated from post element solutions A finite element computer program was developed Exact solutions are compared with the finite element predictions for constant area duct geometries to assess the accuracy of the numerical technique The finite element predictions are compared with experimental values for variable area ducts carrying high subsonic Mach number flows and subjected to plane waves and high order mode excitation
Dissert Abstr

N79-13010*# Bionetics Corp , Hampton, Va
A LABORATORY STUDY OF THE SUBJECTIVE RESPONSE TO HELICOPTER BLADE-SLAP NOISE
Kevin P Shepherd Dec 1978 21 p refs
(Contract NAS1-14970)
(NASA-CR-158973) Avail NTIS HC A02/MF A01 CSCL 20A

The test stimuli recorded during a recent field study consisted of 16 sounds, each presented at 4 peak noise levels Two helicopters and a fixed-wing aircraft were used The impulsive characteristics of one helicopter were varied by operating at different rotor speeds, whereas the other helicopter, the noise of which was dominated by the tail rotor, displayed little variation in blade-slap noise Thirty-two subjects made noisiness judgments on a continuous, 11 point, numerical scale Preliminary results indicate that proposed impulsiveness corrections provide no significant improvement in the noisiness predictive ability of Effective Perceived Noise Levels (EPNL) For equal EPNL, the two categories of helicopter stimuli, one of which was far more impulsive than the other showed no difference in judged noisiness Examination of the physical characteristics of the sounds presented in the laboratory highlighted the difficulty of reproducing acoustical signals with high-crest factors G G

N79-13020*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
INITIAL RESULTS OF A POROUS PLUG NOZZLE FOR SUPERSONIC JET NOISE SUPPRESSION
Lucio Maestrello Nov 1978 21 p refs
(NASA-TM-78802) Avail NTIS HC A02/MF A01 CSCL 20A

As part of a continuing study of possible methods of jet noise reduction, some tests have been made on a porous plug type noise suppressor Very little information exists on the aeroacoustic performance of jet nozzles having porous elements designed to eliminate the shock wave in the exhaust stream and by so doing to eliminate the shock associated noise and screech Some initial results on the aeroacoustic performance of a model porous plug type jet noise suppressor are presented Included are shadowgraph pictures of the flow exhausting from the porous plug nozzle with the comparable acoustic far-field spectra and cross correlations which illustrate the benefits of the test device G Y

N79-13021*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
A THEORETICAL INVESTIGATION OF NOISE REDUCTION THROUGH THE CYLINDRICAL FUSELAGE OF A TWIN-ENGINE, PROPELLER-DRIVEN AIRCRAFT
Rama B Bhat and John S Mixson Dec 1978 47 p refs
(NASA-TP-1325, L-12225) Avail NTIS HC A03/MF A01 CSCL 20A

Interior noise in the fuselage of a twin-engine, propeller-driven aircraft with two propellers rotating in opposite directions is studied analytically The fuselage was modeled as a stiffened cylindrical shell with simply supported ends and the effects of stringers and frames were averaged over the shell surface An approximate mathematical model of the propeller noise excitation was formulated which includes some of the propeller noise characteristics such as sweeping pressure waves around the sidewalls due to propeller rotation and the localized nature of the excitation

with the highest levels near the propeller plane Results are presented in the form of noise reduction which is the difference between the levels of external and interior noise The influence of propeller noise characteristics on the noise reduction was studied The results indicate that the sweep velocity of the excitation around the fuselage sidewalls is critical to noise reduction G G

**N79-13822#** Toronto Univ (Ontario) Inst for Aerospace Studies

**DIRECT CORRELATION OF NOISE AND FLOW OF A JET USING LASER DOPPLER**

W G Richarz Jun 1978 112 p refs Sponsored in part by Natl Res Council of Canada

(Grant AF-AFOSR-2808-75)

(UTIAS-230, CN-ISSN-0082-5255) Avail NTIS HC A06/MF A01

Cross-correlations and cross-spectral densities of the jet noise at 40 deg to the jet axis and the instantaneous turbulent jet flow self and shear source terms were measured at various source positions in the jet Source distributions, inferred over slices of jet normal to the jet axis, were found to be strongly pear-shaped, rather than axisymmetric, with the small end of the pear pointing toward the observer Self and shear noise spectra were constructed from the measured cross-spectral densities by a method consistent with the postulated self/shear noise formalism The two spectra exhibit comparable amplitudes and virtually identical shapes but are displaced substantially in frequency Self and shear noise spectra extracted from far field jet noise intensities exhibit the same behavior On the whole both sets of spectra, although derived from vastly different experimental procedures, are compatible A R H

**N79-13861#** Naval Ocean Systems Center, San Diego Calif

**MANUFACTURING TECHNOLOGY FOR FIBER OPTIC BUNDLE CABLING Technical Report, Dec 1975 - Feb 1978**

G M Holma and R A Greenwell 10 Jul 1978 58 p

(AD-A058954, NOSC/TR-274) Avail NTIS HC A04/MF A01 CSCL 20/6

A manufacturing process was developed for the cabling of bundle optical fibers for use on aircraft The process produces ruggedized optical fiber in large quantities, achieves production cost reduction, and meets the environmental requirements for military aircraft Specifications for the process are given

Author (GRA)

# SUBJECT INDEX



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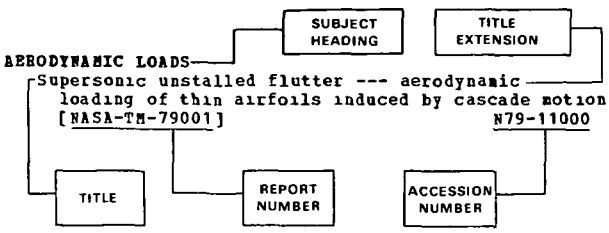


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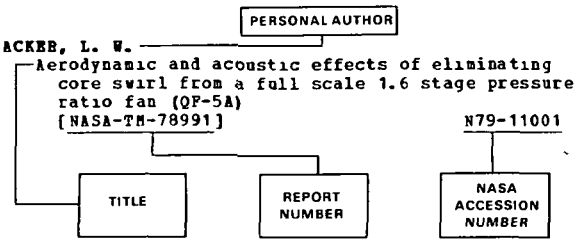


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16. Abstract

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